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RADIO NEWS

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25 Cents
October
1922

Over 175 Illustrations

Edited by H. GERNSBACK

Is the Radio Amateur doomed? $500.00 in Prizes to save him

See Page 624

CIRCULATION LARGER THAN ANY OTHER RADIO MAGAZINE

Cunningham tubes

The Heart of Your Home Receiving Set

AMPLIFIES AS IT DETECTS

—enjoy clear reception by using Cunningham Tubes

Cunningham Detector Tube, type C-300, insures clearest reception for all radio messages, concerts, press and weather reports.

The rigid specifications to which these tubes are built in the General Electric Laboratories determine their uniform operation and perfect clearness.

Cunningham Amplifying Tube, type C-301, is conceded to be the most efficient amplifier ever produced. For complex and multi-stage circuits, freedom from distortion and absence of all tube noises as well as for the operation of loud speaking telephones and devices requiring considerable power, this tube has no equal.

If your dealer cannot supply you, write us direct for the name of a Radio Dealer who can.

TYPE C-300
GAS CONTENT DETECTOR
$5.00

TYPE C-301
HIGH VACUUM AMPLIFIER
$6.50

PATENT NOTICE
Cunningham tubes are covered by patents dated 11-7-05, 1-15-07, 2-18-08 and others issued and pending. Licensed only for amateur or experimental uses in radio communication. Any other use will be an infringement.

The trade mark GE is the guarantee of these quality tubes. Each tube is carefully inspected and tested before leaving the G. E. factory.

E. J. Cunningham

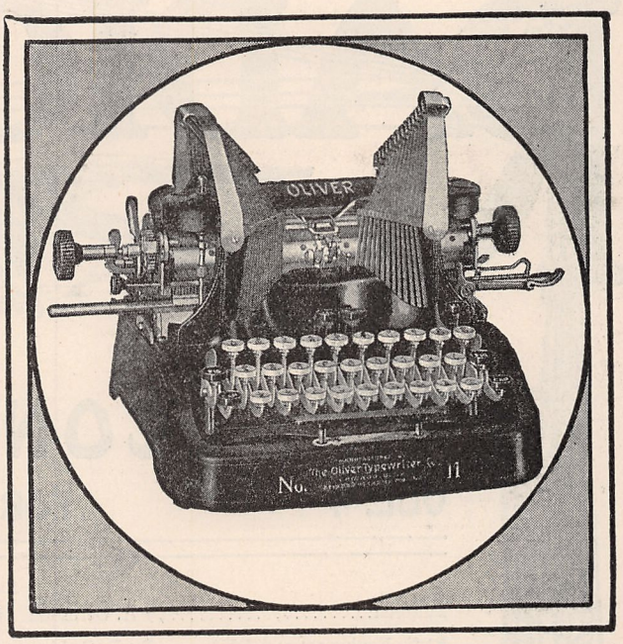
248 First Street
San Francisco, Calif.

Trading as
AUDIOTRON MFG. COMPANY

154 West Lake Street
Chicago, Illinois

ANNOUNCING

The New OLIVER SPEEDSTER



Our latest and finest model, No. 11

Now, in our 27th year, we introduce a new-day perfection in typewriters, a super-typewriter, one with an ancestry of 1,000,000 Olivers. It embodies many advancements, countless refinements. It is the climax of years of development.

We want everyone who is planning to buy a typewriter to become acquainted with this remarkable Oliver Speedster. Note our offer below. To see it, to operate it, brings a new appreciation of the ultimate.

The Oliver Speedster discards many old ideas, many limitations. It brings dozens of improvements which you will appreciate quickly. To own an Oliver Speedster—years ahead in design—means a new satisfaction.

No one now can afford to buy any typewriter without first investigating this advanced and wonderful Oliver, the finest, the most durable, the quietest model we've ever built.

Save $35

While we retain all the fundamental and proven features which have brought such fame to earlier models, and while we bring improvements not to be found elsewhere, we do not revert to the customary $100 price.

The new Oliver Speedster, worth $100 if any typewriter is, is sold from factory-to-you, at $65, saving you the $35 that it formerly cost to sell an Oliver.

Our policy, since 1917, has been to produce the finest typewriter possible at the lowest cost. We have eliminated extravagant, roundabout selling plans, and substituted the popular factory-to-you plan. The Oliver sells itself. It must prove that it is the finest, regardless of price.

Free Trial

We ship the new Oliver Speedster to you for five days free trial. That is the best way for you to become acquainted with its advancements. Use it as if it were your own. Note its superiorities. Compare it. See what the numerous improvements offer.

Then if you agree that it outclasses any typewriter on the market, and want to buy it, send us only $4 after trial, then $4 per month. If you do not want to keep it, ship it back at our expense.

This free trial does not obligate you to buy. It is part of our new plan. You are the sole judge. The coupon brings the Oliver, or further information. Check which you desire.

The Oliver Typewriter Company
637 Oliver Typewriter Building
Chicago, Ill.

Mail Now

THE OLIVER TYPEWRITER COMPANY
637 Oliver Typewriter Building, Chicago, Ill.

☐ Ship me a new Oliver No. 11 Typewriter for five days' free inspection. If I keep it I will pay $65 as follows: $4 at the end of trial period and then at the rate of $4 per month. The title to remain in you until fully paid for. If I make cash settlement at end of trial period I am to deduct ten per cent and remit to you $58.50. If I decide not to keep it, I will ship it back at your expense at the end of five days.

My shipping point is _____

☐ Do not send a machine until I order it. Mail me your book—"The High Cost of Typewriters—The Reason and the Remedy," the Speedster catalog and further information.

Name _____

Street Address _____

City _____ State _____

Occupation or Business _____

RADIO NEWS

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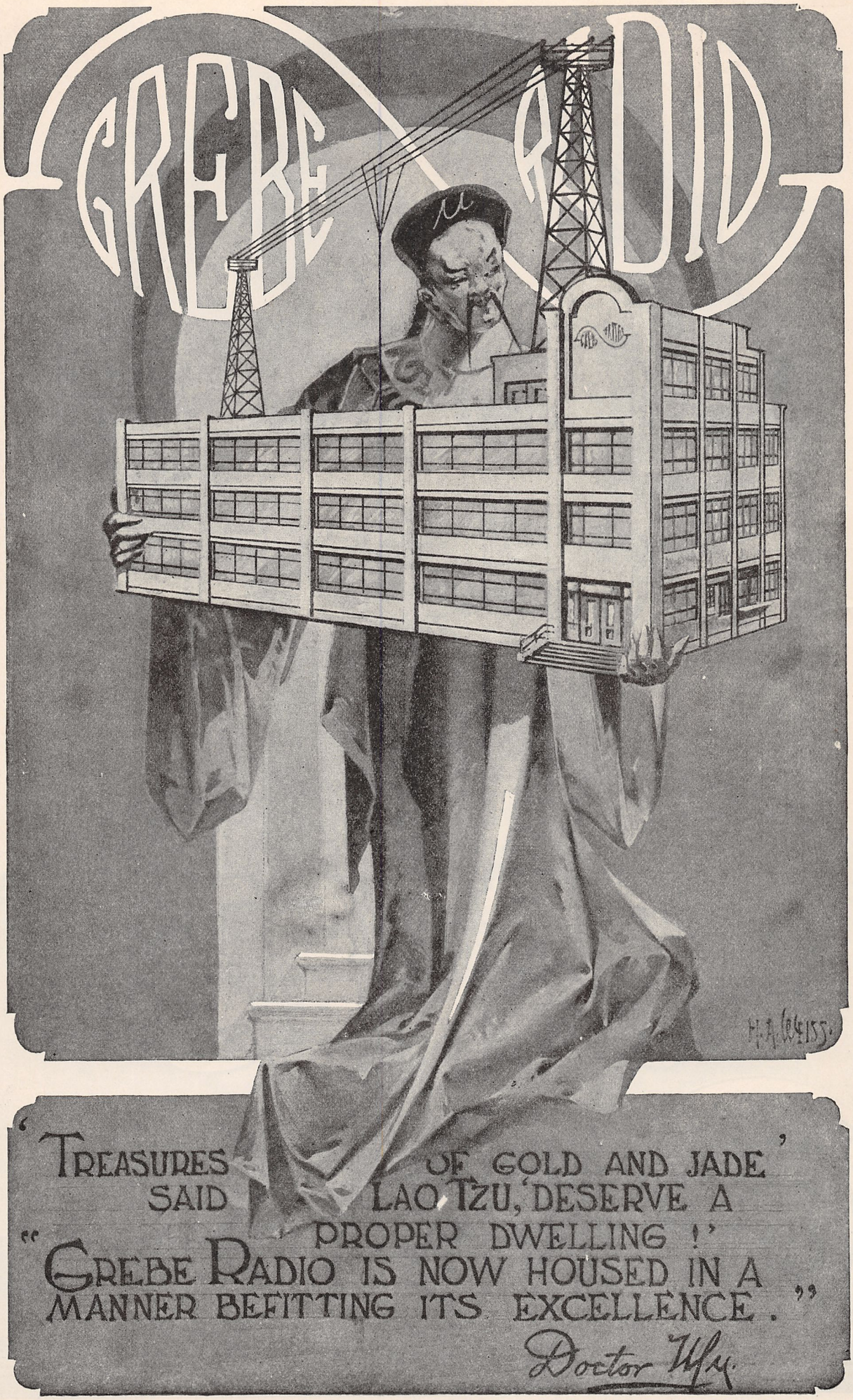

GREBE RADIO
"TREASURES OF GOLD AND JADE" SAID LAO TZU, "DESERVE A PROPER DWELLING!"
"GREBE RADIO IS NOW HOUSED IN A MANNER BEFITTING ITS EXCELLENCE."
Doctor Wu.

FROST
FONES
Best for Your
Receiving Set
Like Postage Stamps
FROST RADIO
154 W LAKE ST.
CHICAGO.ILL.
Used Everywhere
HERBERT
NATIONAL FACTORY DISTRIBUTORS
154 W. LAKE ST.

A Quality Achievement

No. 162 . . $5.00
2000 Ohm Set

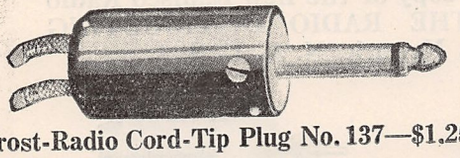
No. 163 . . $6.00
3000 Ohm Set

Fully Guaranteed by the Name

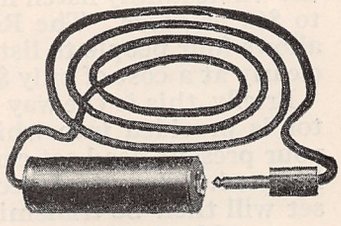
The Ideal Receivers for Use With Home Radio Receiving Sets

Frost Improved Plugs

Frost-Radio Plug No. 132—$1.00

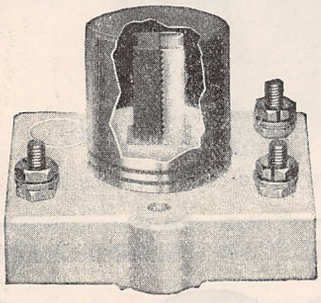


Frost-Radio Cord-Tip Plug No. 137—$1.25



Frost-Radio Extension Cord
Lengths from 10 to 100 feet

Loud speaker can be placed anywhere and connected with Radio Set with Frost-Radio Extension Cord.



FROST-RADIO PROTECTOR

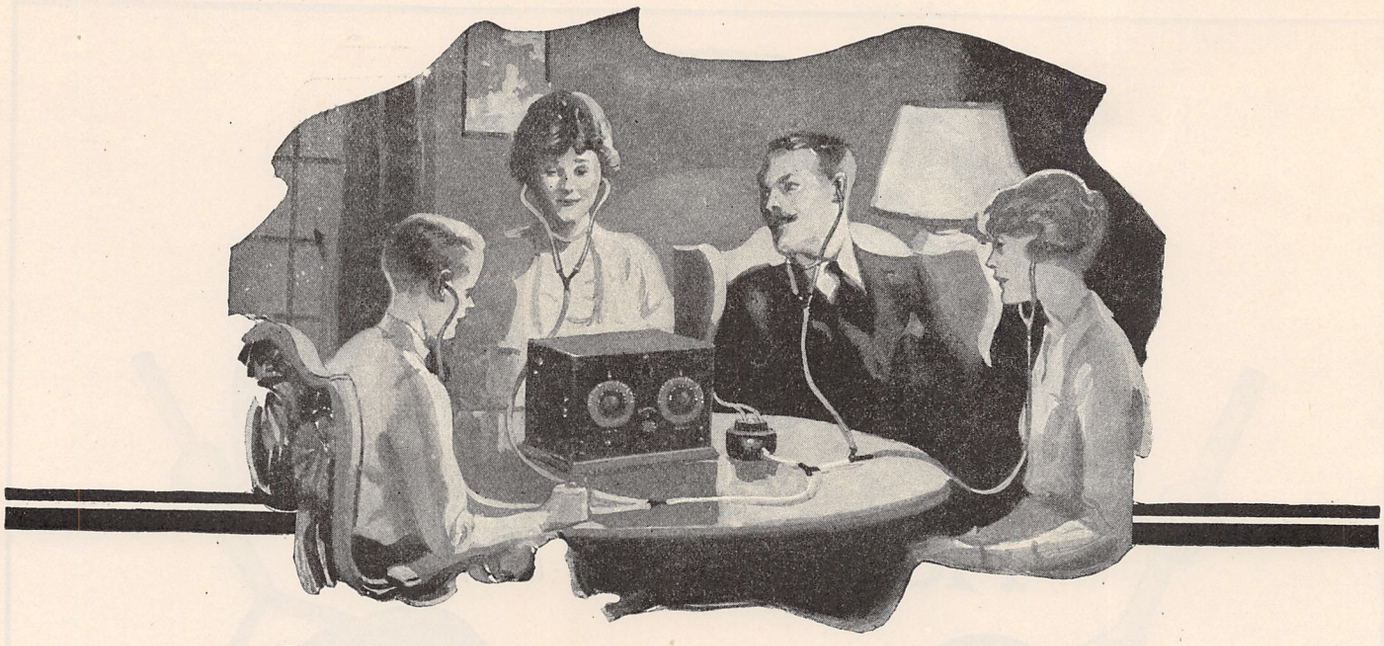
Listed by Underwriters' Laboratories under April, 1922, Regulations. No interference. Never grounds. Mounts indoors. Price $1.50. Good deliveries on this approved device.

Like Postage Stamps — FROST RADIO — 154 W. LAKE ST. CHICAGO, ILL. — Used Everywhere

H. FROST

TO THE ELECTRICAL-RADIO JOBBER

CHICAGO, ILL. U.S.A.

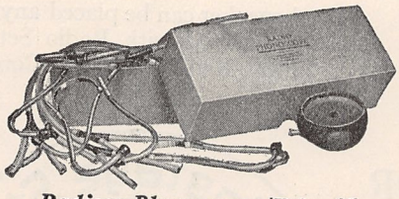


4 People for $5

THAT'S what the Radisco Phonoscope means to your radio receiving set. Four people can listen in on a crystal or audion set where only one could before with ordinary head phones. Since head phones cost from $5 to $15 each the expense for phones to let the whole family listen in would be from $20 to $60 or more. The Radisco Phonoscope allows four people to listen in as easily and clearly at a cost of only $5.

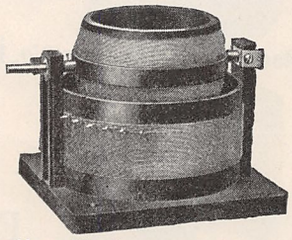
Briefly, this is the way it works. A receptor is provided into which one receiver of your present head set can be automatically inserted. The signals received by your head set will then be transmitted through pure para rubber tubing to the four listening ends of the Phonoscope itself. These are very comfortable and easily adjustable to the tension you desire. Four people for $5 can hear each concert comfortably.

The Phonoscope is but one of the hundred products sold by the Radio Distributing Company and its agents throughout the country. If your dealer cannot supply you, send money direct with name of dealer. Money gladly refunded within 15 days if you are not perfectly delighted with the results you secure. 10c to cover mailing charges will bring you a copy of the new Radisco Radio Catalog. THE RADIO DISTRIBUTING COMPANY, Newark, N. J., U. S. A.



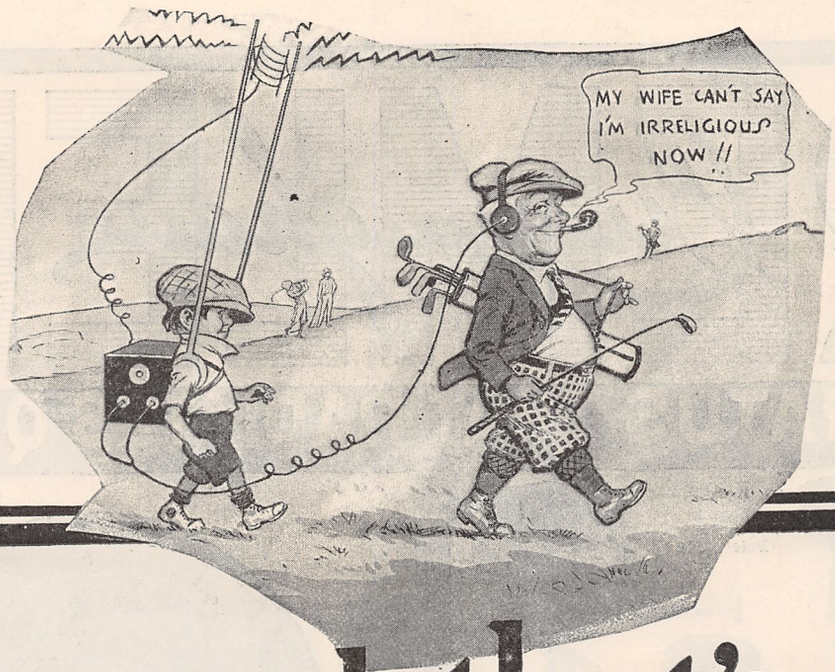
Radisco Phonoscope, Price $5

Radisco Heliphone, Price $5
(Pocket receiver)



Radisco Vario-coupler, Price $6.50

RADISCO
RADIO PRODUCTS

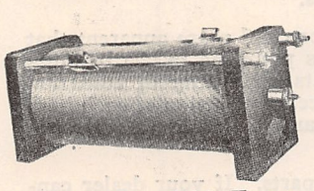


- and that's not all

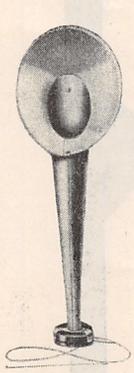
OF course we are not seriously advocating that golf enthusiasts proceed to equip themselves with a radio set while playing, still they will find a radio set just as refreshing as the nineteenth hole, especially after supper on the veranda. If it's too cool to sit outside there is no better fun than listening in on the news and doings of the world over one of the many types of Radisco receiving sets.

These sets may be had in a range of prices suitable to the most lean and emaciated or plump and prosperous pocket-books. There is a set suitable for Tommy just turning seven and another for his dad who owns the only bank in town. Some Radisco receiving sets are of the simple crystal detector type and others range up to the long range high power set with two stages of amplification and loud speaker attachment so a whole roomful can hear.

In addition to complete sets the Radisco line comprises all kinds of radio parts and accessories. There is great fun in building your own set. Write us for full information and interesting radio catalog. THE RADIO DISTRIBUTING COMPANY, Newark, New Jersey, U. S. A.



Radisco Two Slide Tuner
Price $4.00



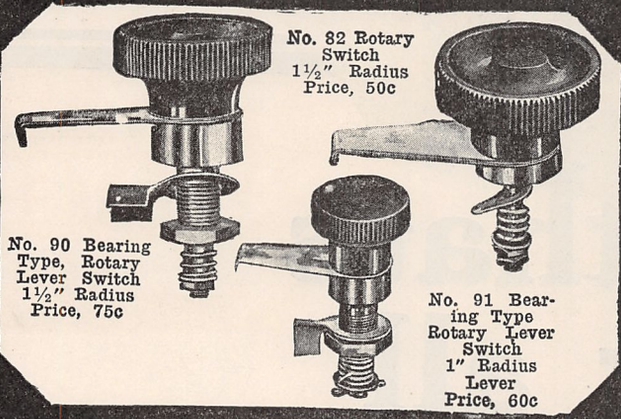
Radisco Lily Horn and Coupler
Scientifically designed fibre horn; no distortion, only 95c. Coupler connects all makes of phones to Victor, Columbia and other phonographs—also to Lily Horn. Price 60c.

Radisco Duplex Phonograph Adaptor
Price $2.50

RADISCO
RADIO PRODUCTS

REMLER Cunningham

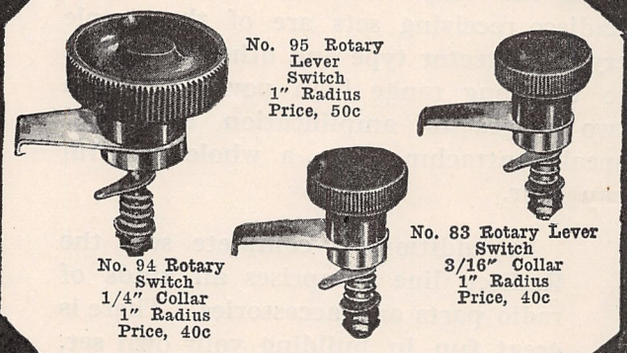
APPARATUS THAT RADIATES QUALITY



No. 82 Rotary Switch 1½" Radius Price, 50c

No. 90 Bearing Type, Rotary Lever Switch 1½" Radius Price, 75c

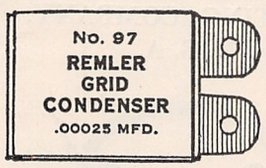
No. 91 Bearing Type Rotary Lever Switch 1" Radius Lever Price, 60c



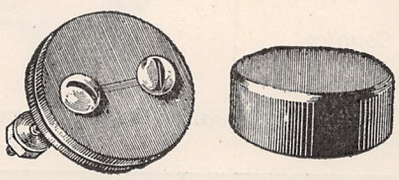
No. 95 Rotary Lever Switch 1" Radius Price, 50c

No. 94 Rotary Switch 1/4" Collar 1" Radius Price, 40c

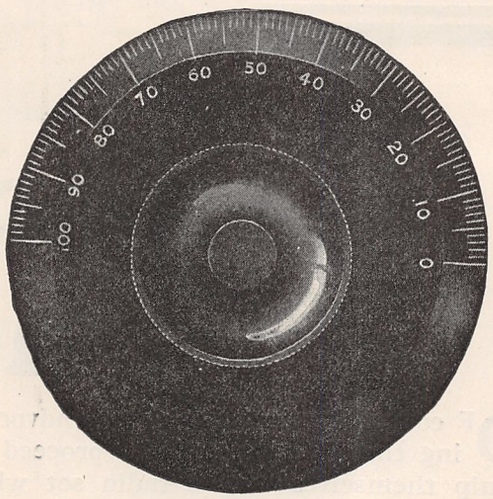
No. 83 Rotary Lever Switch 3/16" Collar 1" Radius Price, 40c



No. 97 Fixed Grid Condenser Price, 20c



No. 96 Variable Grid Leak Price, 40c



Type No. 100
3-inch Bakelite Dial with Knob and Bushing 75c

Remler Parts For Your Set

On this page are shown the popular line of Remler switches, the Remler Fixed Grid Condenser, the Remler Variable Grid Leak and the famous Remler Dial.

This represents but a small fraction of the Quality Radio Apparatus that has put Remler in the leading position it holds today. This small fraction, however, is built with the same care, accuracy and precision that has made the entire Remler line universally known as Quality Radio Apparatus.

It is becoming more and more apparent that Remler Apparatus is preferred in the building of sets because of its uniformity of construction—the well balanced proportion of each item giving an accurate and a pleasing appearance to the finished set.

Insist on Remler parts. If your dealer cannot supply you, write us direct for the name of a Radio dealer who can.

REMLER RADIO MFG. CO.

E.T. CUNNINGHAM GENERAL MGR.

248 FIRST ST. SAN FRANCISCO, CAL. 154 W. LAKE ST. CHICAGO, ILL.

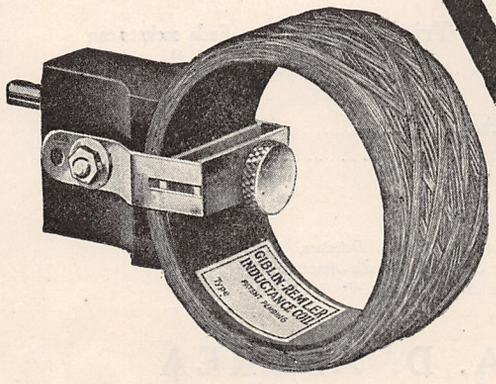
REMLER Cunningham

APPARATUS THAT RADIATES QUALITY

Giblin-Remler INDUCTANCE COILS

Type and Number of Turns, Mounted	Price, Mounted	Type and Number of Turns, Unmounted	Price, Unmounted	Inductance in Millihenrys at 1000 cycles. Accuracy ½%	Natural Wave Length in Meters. Accuracy ½%	Distributed Capacity, in micro-micro-farads, Accuracy 1%	Wave Length Range in Meters using Condenser of .001 max. and .00004 mfd. min. Min.	Max.	High Frequency Resistance in Ohms at Wave Length shown 200	500	1000	2000
RG 20M	1.50	RG 20U	.70	.030	39	14.3	63	334		1.1		
RG 25M	1.50	RG 25U	.70	.041	47	15.2	75	389		1.5		
RG 35M	1.50	RG 35U	.70	.083	87	25.4	128	550		3.5		
RG 50M	1.60	RG 50U	.80	.169	114	21.6	185	785		8.8	4.4	
RG 75M	1.65	RG 75U	.85	.377	163	19.8	266	1170		28.3	12.1	6.2
RG 100M	1.70	RG 100U	.90	.666	217	19.9	358	1550		80.3	26.8	12.6
									1000	2000	5000	10000
RG 150M	1.75	RG 150U	.95	1.503	281	14.8	512	2320	69.8	23.8	7.1	
RG 200M	1.80	RG 200U	1.00	2.68	374	14.7	690	3110		50.6	12.5	
RG 250M	1.90	RG 250U	1.10	4.20	424	12.1	860	3880		87.5	19.9	
RG 300M	2.00	RG 300U	1.20	6.11	494	11.2	1030	4680		141	29.3	13.8
RG 400M	2.10	RG 400U	1.30	11.04	618	9.7	1380	6300			54.6	22.3
RG 500M	2.30	RG 500U	1.50	17.50	747	9.0	1730	7900			93.1	34.9
									2000	5000	10000	20000
RG 600M	2.40	RG 600U	1.60	29.2	1024	10.1	2260	10250		111	43.8	
RG 750M	2.65	RG 750U	1.85	39.0	1249	11.3	2660	11850			64	
RG1000M	3.40	RG1000U	2.50	71.6	1620	10.3	3570	16000			123	
RG1250M	3.80	RG1250U	2.90	108.0	1930	9.7	4380	19700				
RG1500M	4.40	RG1500U	3.50	159.8	2300	9.3	5300	23800				

This table compiled by Robert F. Field of Cruft High Tension Electrical Laboratory, Harvard University, Cambridge, Mass.



Maximum Inductance and Minimum Distributed Capacity

The Ideal Loading Coil

These new inductance coils will increase the wavelength range of your short wave receiving set.

There is nothing more fascinating than the reception of radio messages from high-power stations located thousands of miles away. These stations use wave lengths between 1000 and 25,000 meters. This is far above the receiving range of the average receiver designed for amateur broadcast reception.

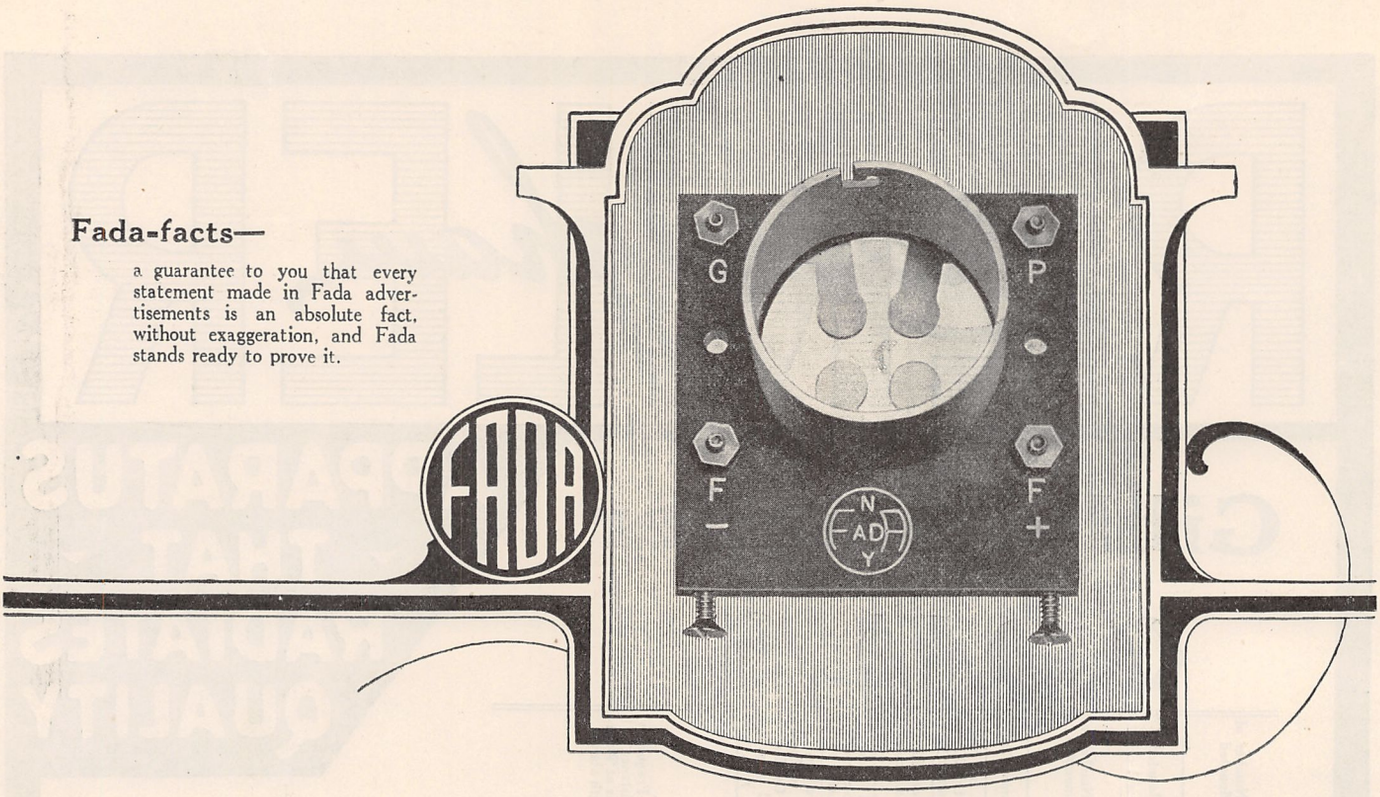
Inserting Giblin-Remler Coils of the proper values (determined from the table shown on this page) and shunted by a variable condenser, in series with the antenna circuit and the secondary circuit of your receiver, will increase its wavelength range any desired amount.

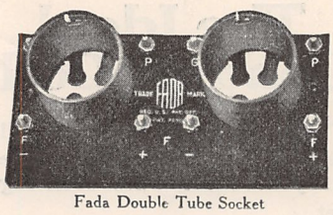
The Giblin-Remler Coil makes possible the reception of high-power, long wave foreign stations, as well as time signals, press and weather reports from various naval stations thruout the United States.

REMLER RADIO MFG. CO.
E. T. CUNNINGHAM
General Manager
248 First Street, San Francisco, Calif.
154 W. Lake Street, Chicago, Ill.

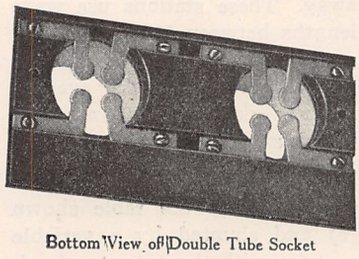
Fada-facts—

a guarantee to you that every statement made in Fada advertisements is an absolute fact, without exaggeration, and Fada stands ready to prove it.

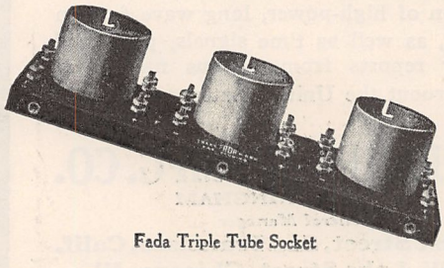




Fada Double Tube Socket



Bottom View of Double Tube Socket



Fada Triple Tube Socket

Nine Reasons Why—

Fada Sockets are Good Sockets

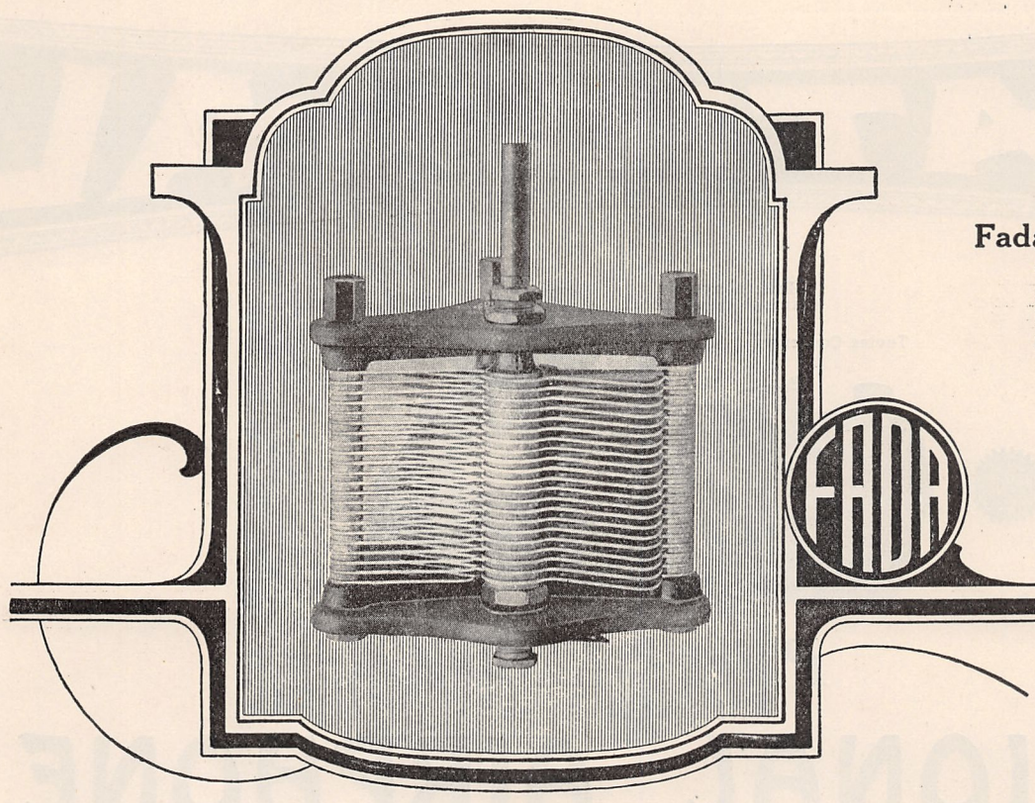
1. **Base is made of genuine Condensite.** High frequency insulation resistance meaning little voltage losses
2. **Contact Springs set in Trenches.** Springs are thus immovable except as a tension against the tube contact points.
3. **Contact Springs made of Phosphor Bronze.** The best spring temper with grain of metal lengthwise of spring.
4. **Metal Inserts in Base** threaded for panel mounting. No chance of cracking base when assembling.
5. **Socket Tube is offset on Base.** So designed to allow ample room for mounting Fada rheostat back of socket.
6. **Brass Socket Shell** and can't break at the bayonet joint like the moulded shellac or porcelain sockets.
7. **Screw Holes for Base Mounting.** All screws are countersunk below the surface so socket can be set on metal without shorting connections.
8. **Terminals are Plainly Marked.** Four terminals are marked and filament battery polantic shown.
9. **Single, Double and Triple Sockets.** Fada sockets can be supplied in these sizes.

Single Tube Socket	$1.00
Double Tube Socket	2.00
Triple Tube Socket	3.00

Fada Rheostats, Switches, Crystal Detectors, Vario-Couplers, Receiving Sets, and Detector-Amplifiers are good instruments. Ask your radio dealer.

FRANK A. D. ANDREA
1581-A JEROME AVE., NEW YORK CITY

Fada-Facts



Fada-facts—

To purchase with the confidence that your money is well spent, read Fada facts. Then buy Fada equipment from your local radio dealer.

A New Arrival—

Fada Variable Condensers

Seven points in the construction of Fada Variable Air Condensers that places them among the best on the market.

1. **End Plates made of Condensite.** A good insulator that protects you from condenser losses.
2. **End Plates ribbed to secure extra strength.**
3. **Plates made of hard Aluminum.** Every plate perfectly flat, true and accurate.
4. **Spacing Washers Uniform.** Special manufacturing method makes washers true to size and perfectly flat.
5. **Positive Thrust Adjustment.** Socket nuts designed to give permanent adjustment at both end plates.
6. **Rotary Motion Positive.** Holds any setting because of good thrust adjustment and steel spring washer.
7. **Larger Capacities at Less Cost.** Fada Condensers are so accurately made and assembled with uniform spacing of plates that the capacity of the 23 plate unit is as high as .0007 mfd.

3 Plate (vernier)	.0006 mfd	$2.50
13 Plate	.0004 mfd	3.50
23 Plate	.0007 mfd	4.00
43 Plate	.0015 mfd	4.50
23 Plate (vernier)	.0007 mfd	6.00
43 Plate (vernier)	.0015 mfd	6.50

A new Fada catalogue handbook is now ready. This book is not for sale but a copy will be promptly mailed upon receipt of 5 cents to cover postage. It's a How-To-Do-It Book and you should have it.

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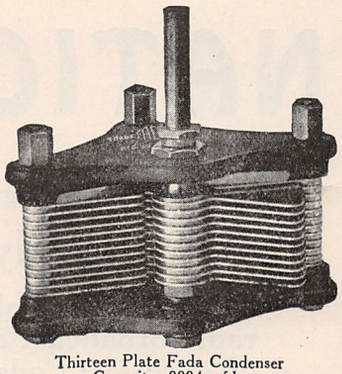
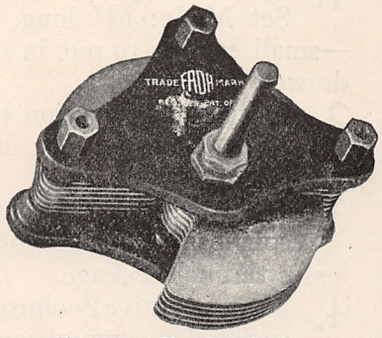
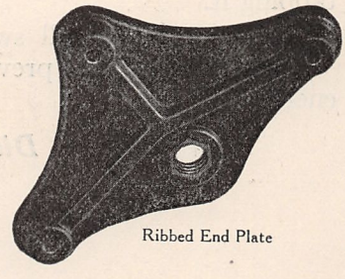


Thirteen Plate Fada Condenser
Capacity .0004 mfd.

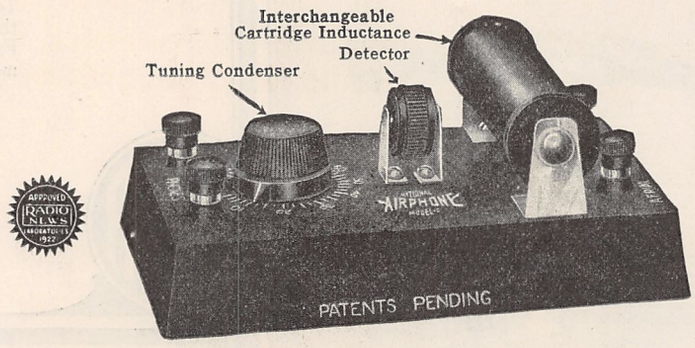


Twenty-three Plate Fada Condenser
Capacity .0007 mfd.



Ribbed End Plate

NATIONAL



Price $12.50

(Without Phones)

NATIONAL AIRPHONE

(MODEL G)

Endorsed by Engineers as the Greatest Radiophone Ever Seen or Heard

Easily Operated Even by a Child

To operate simply connect aerial, ground and head-phones. Will receive radio broadcast entertainments and commercial reports within a radius of 25 miles; Code signals 1000 miles and over depending upon coils used.

Outstanding Points of Superiority:

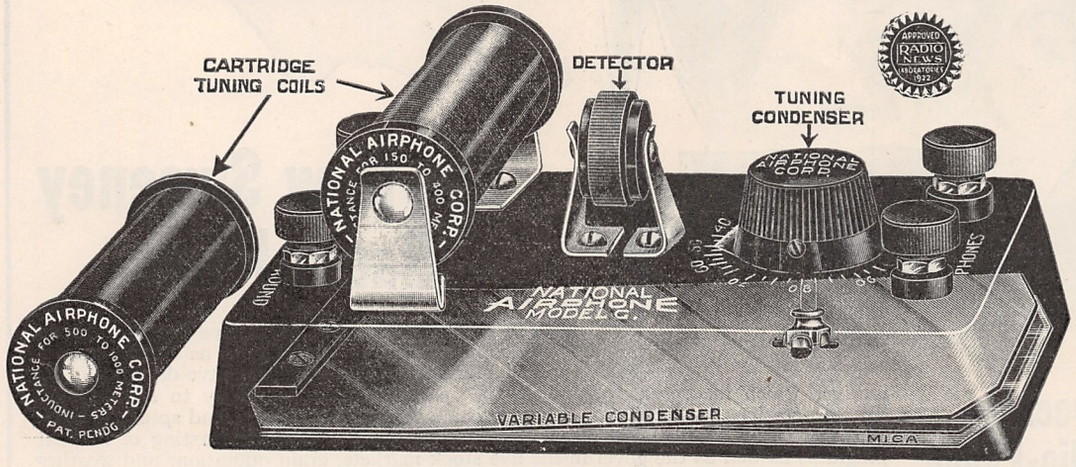
1. Most Compact Radiophone Receiving Set Made: $6\frac{1}{2}''$ long, $4\frac{1}{4}''$ wide, $2\frac{3}{4}''$ high —small enough to put in coat pocket or desk drawer.
2. Rugged construction throughout, nothing to get out of order, insuring long life in service.
3. Entire casing constructed of hard rubber composition. No wood, no warping, no losses through leakage.
4. Ultra-sensitive Foolproof Detector; entirely enclosed in composition case. Air and dust proof, no fussy minerals, no Catwhisker, no balls nor springs. To adjust for maximum sensitivity simply rotate the black disk slowly while tapping it.
5. Elimination of all switches, current taps and switchpoints prevents loss of electrical energy.
6. Use of interchangeable cartridge tuning coils gives wide range over which radiophone broadcast or radio telegraph signals can be heard. 25 miles or over for radiophone concerts; up to 1000 miles for telegraph signals depending upon coils used.
7. Two Cartridge tuners, supplied with each outfit; one takes in general broadcasting stations 150 to 400 meters, the other ranges from 500 to 1000 meters.
8. Variable Mica Condenser used is acme of simplicity—high capacity, impossible to short-circuit.
9. Anyone without previous experience can operate a NATIONAL AIRPHONE, no delicate adjustments necessary, no fussing.

***Distributors*—Write for Exclusive Territory**
***Dealers*—Send for Price List**

TRADE MARK **18 Hudson St.** NATIONAL AIRPHONE CORPORATION REG. U.S. PAT. OFF. **New York**

AIRPHONE

Pronounced by Experts to Be the Greatest Radiophone Crystal Outfit Ever Produced. Awarded the Certificate of Merit by the "Radio News Laboratories"



$12.50 Without Phones

Patents Pending

Highest Grade Crystal Receiving Set

No Distortion. Perfect Reproduction of All Sounds With Extraordinary Clarity

The above illustration shows a phantom view of the NATIONAL AIRPHONE MODEL G. It is a perfect crystal radiophone of compact and rugged construction, guaranteed to receive broadcast entertainment within a radius of 25 miles, and code signals 1,000 miles and over, depending on location and cartridge tuning coils used. The NATIONAL AIRPHONE is the highest attainment in crystal radio receiving sets and is the culmination of years of work by some of our greatest radio experts and engineers.

It is built along radically different principles and embodies in its superior construction all those features which inventors and manufacturers have been striving to achieve for years. By reason of its superior scientific construction there are no electrical losses whatsoever; not a piece of wood is used—only hard rubber composition. In the NATIONAL AIRPHONE, every detail has been worked out carefully and logically. If you have ever experienced trouble with other crystal receivers and you know what an annoyance it is to fuss around with catwhiskers, crystals, sliders, springs and other fussy adjustments, the NATIONAL AIRPHONE will prove a revelation. You will know what pleasure it is to own "The little wonder AIRPHONE."

Super-Sensitive Detector

Our super-sensitive detector is a revelation. It is positively more sensitive than any other crystal detector, and brings in the sounds incomparably stronger, clearer and louder than the ordinary catwhisker type. It is self-cleansing and remains sensitive practically all the time, EVEN DURING THE USUAL STATIC.

Tuning Condenser and Tuning Coils

By means of the tuning condenser interference can be eliminated successfully by merely turning the knob. If you wish to receive a station of longer wave-length, snap into place the interchangeable cartridge tuning coil, for which purpose two coils are furnished with each outfit. It will be noted that the variable condenser is of a special design, with mica dielectric, making it one of the best radio condensers known.

Construction

By reason of the highly-developed scientific construction of the outfit there are no electrical losses whatsoever, not a piece of wood being used, only hard rubber composition. All screws are secured with lock washers, impossible to become loose, and all necessary connections are soldered. The cartridge tuning coils are wound with enameled wire and calibrated for the right wave-lengths. Every part utilized in the manufacture of the NATIONAL AIRPHONE is rigidly tested and examined, and each AIRPHONE is separately tested under actual broadcasting conditions before shipment.

So Simple to Operate

To operate the NATIONAL AIRPHONE, just connect the aerial and ground wires to the proper binding posts and attach the head phones. Then, if you wish to listen to a broadcasting concert, snap into place the cartridge tuning coil marked "150 to 450 meters," turn the large knob of the tuning condenser while tapping the detector wheel slightly. If broadcasting is going on, stop the pointer of the condenser knob at the point where the sounds come in loudest and clearest. Leave the adjustment at that point and then ENJOY YOURSELF.

TESTIMONIALS

Rocky Mountain Radio Corporation, Denver, Colorado: "Our organization tickled to death with AIRPHONE. What proposition are you willing to offer on distribution of AIRPHONE, Rocky Mountain Region?"

Canadian Wireless Telephone Co., Toronto, Canada: "Set satisfactory. Our engineers say your crystal set is the best seen or heard. Have arranged distribution details for Ontario and Quebec provinces, subject to your granting. Next ninety days can distribute five thousand sets or more Ontario."

Edwin A. S. Brown, Hoboken, New Jersey: "I find that the AIRPHONE is a marvel in its compactness and simplicity. The sounds brought in by the phone are clear and with no interference. It gives perfect satisfaction."

William Doniger, Cedarhurst, Long Island: "I have recently bought one of your Model G radio sets. It works wonderfully."

John Schury, Detroit, Michigan: "I have received the receiving set which I recently ordered from your firm and am pleased to advise that same is very satisfactory."

For Further Details See Description on Opposite Page

If Your Dealer Cannot Supply the National Airphone Model G, Mail This Coupon Today!

NATIONAL AIRPHONE CORP.,
18 Hudson Street, New York City.

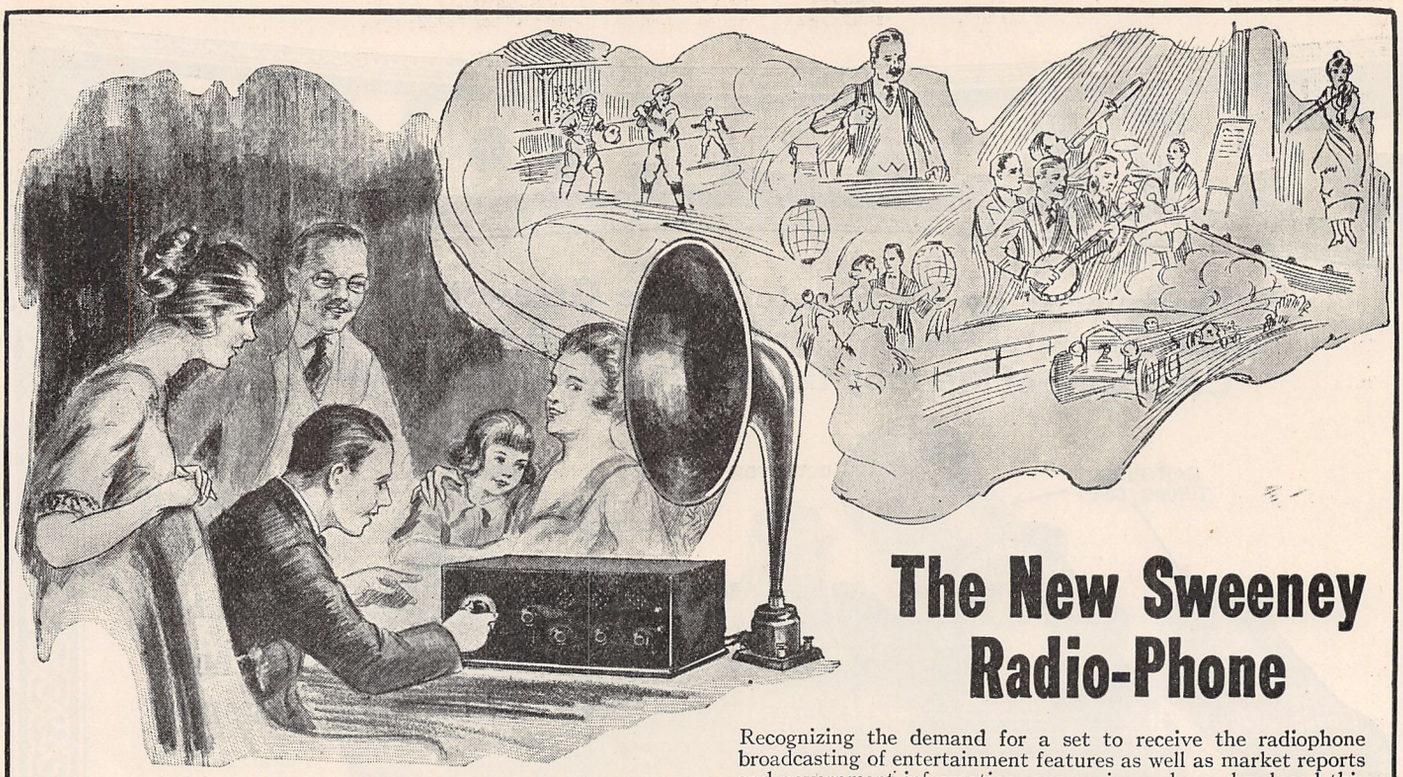
Gentlemen:

Please send me, prepaid, one (1) guaranteed NATIONAL AIRPHONE MODEL G, as advertised, for which I inclose { money order / check } for $12.50. If at the end of five (5) days I should not find the set to be all that you claim for it, I will return it promptly and you will refund me the full purchase price.

NAME.....

Street Address.....

City and State.....



The New Sweeney Radio-Phone

Recognizing the demand for a set to receive the radiophone broadcasting of entertainment features as well as market reports and government information, our engineers have developed this receiver which incorporates simplicity of operation with its ability to receive long distance stations with clearness and sufficient volume to operate a loud speaking horn. The wave length range will cover those being used for the broadcasting of musical programs as well as the government live stock markets, grain quotations and weather forecasts. All sets are carefully constructed with the best quality of material and most careful workmanship. Each set is rigidly examined and tested before it is released. Radio frequency amplifications, one of the newest developments in radio reception, is used, which accounts for the extreme sensitivity of the instrument and enables the operator to pick up long distance stations. The audio frequency amplification increases the signal strength to such a volume that any type of loud speaking horn at present on the market may be operated. Write for special low introductory price.

Specifications Sweeney Radio-Phone

Cabinet: Genuine solid walnut, hand rubbed.

Circuits: Tuning circuit consists of an antenna inductance with four taps and a series variable condensers wave lengths from 175 to 550 meters. Two audio frequency amplifying tubes.

Panel: Bakelite 7x20¾. 3/16 inch thick *Control Knobs.* Smooth running and easily adjusted. Only two adjustments required in tuning.

Terminals are in rear of the cabinet to which the aerial ground, A battery and B battery are connected.

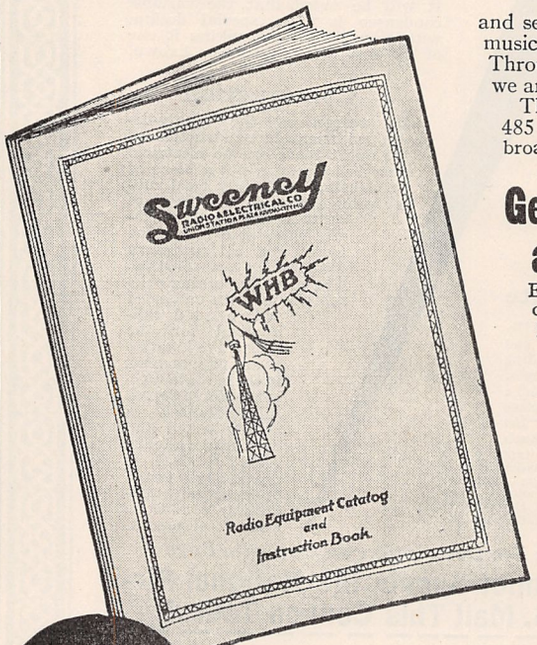
Wiring and connections substantially made with 1/16 inch brass rod with cambric tube sleeving.

SWEENEY BROADCASTING W. H. B.

This Is One of the Largest Inland Stations in the Country

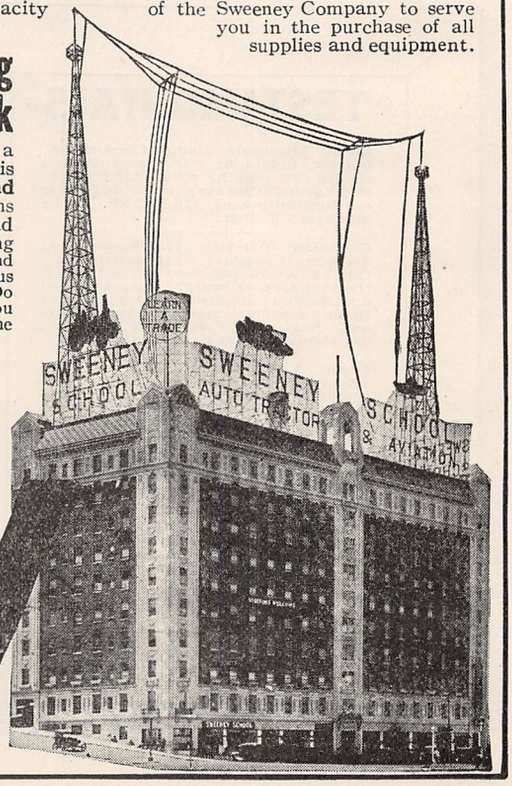
and sends out official Government market and weather reports every day, besides giving musical, educational and religious programs on Sundays, Tuesdays and Thursdays. Through the courtesy of C. G. Conn & Co., Elkhart, Ind., Makers of Musical Instruments, we are broadcasting some of their concerts.

This station cost $20,000 to erect. CALL IS—WHB—360 meters for concerts and 485 for Government reports. 500 watts W. E. set provides its power. This great broadcasting station is evidence of the capacity of the Sweeney Company to serve you in the purchase of all supplies and equipment.



Get This Radio Catalog and Instruction Book

Every radio enthusiast should have a copy of this valuable book which is just off the press. Contains new and interesting matter and descriptions and hints that will save you time and money, including hookups showing connections of crystal, regenerative, and high frequency amplification apparatus and give you much better results. Do not buy any radio supplies until you have seen this book as we have gone into this business on a great scale and are prepared to supply you with the best and most efficient new material at lowest prices. This book has has been prepared by some of the best known electrical and radio engineers and practical instructors. *Sent on receipt of fifteen cents in stamps.* Get your copy today.



Sweeney

RADIO & ELECTRICAL CO

1023 UNION STATION PLAZA, KANSAS CITY, MO

RADIO NEWS

H. GERNSBACK—Editor and Publisher
ROBERT E. LACAULT—Associate Editor

EDITORIAL AND GENERAL OFFICES, 53 PARK PLACE, NEW YORK

Vol. 4 OCTOBER, 1922 No. 4

Needed Radio Improvements

OCTOBER marks the renewal of radio activities in this country. This time of the year, every radio amateur, every fan, is beginning to take renewed interest in his radio outfit, after the vacation period, and is trying to catch all that is going on in the air.

During the past summer broadcasters have not been asleep, either, and in a great many instances have improved their transmitting stations to a greater degree, so that broadcasted entertainment should now be of a vastly better quality than it was last spring.

We must now indulge in some straightforward talk, and must point out to our manufacturers why, after the winter and spring boom, there was such a tremendous falling off in interest on the part of the American radio public. The main reason, of course, was because too much poor apparatus was foisted upon an unsuspecting public.

Time and again, novices, buoyed up by the glowing reports they read on radio, bought poor equipment, which was promptly discarded, with the result that there was at once a man in the community who did all in his power to denounce radio. If there had been only a few of these, no great harm would have been done, but there were literally tens of thousands who were thus taken in and even now the victims have not a good word left for radio.

What the radio industry must do now, more than ever before, is to clean house, and make a clean sweep. Every instrument, every piece of apparatus that leaves the factory without giving 100 per cent. satisfaction to the user will prove a boomerang six months hence, when the public will refuse to buy. There has been too much poor equipment and flooding of the market with junk, and we cannot be too strong in our denunciation of such malpractice as was, and still is, rampant.

Another thing that has destroyed sales and taken away the confidence of the public is the loud-talker. Unless this instrument is carefully constructed, not only by radio experts, but acoustic experts as well, such an instrument will drive more prospects away than is imagined in some quarters. We have actually seen people standing in front of stores and after listening to some of these atrocities they turned away in disgust, saying, "If that is radio, I want none of it."

The fault in this case is not always in the loud-speaking device, but in the ignorance of the dealer or the man who displays the instrument, and who does not know how to get results from it. When amplification reaches beyond a certain stage, particularly where the regenerative effects are used, it becomes exceedingly difficult to avoid distortion. Even the best loud-talkers distort pretty badly, unless operated or used by an expert who knows radio from the ground up. But when the average person buys one of these instruments he very seldom gets results that are worth while and that will make for future sales. When a novice in radio operates one of these horns or loud-talkers, there is not one chance in ten that he will get the proper results, and then, when his friends come to listen to the news, music, or lectures, they may marvel at it, but as a rule they are not favorably impressed, and they do not often wish to invest their money in a similar outfit.

These conditions have killed literally a hundred thousand sales all over the country, and it is up to our manufacturers to rectify these conditions. With the exception of two or three loud-talkers, there are none that give real results.

The mischief becomes even greater when horns alone are sold, made for the purpose of attaching a headset or single receiver to them. The reason is that no two makes of receivers will work the same with such horns. The size of the diaphragm and the strength of the magnets, besides a hundred other factors, contribute toward distortion, and it is impossible for a manufacturer of a horn attachment to know in advance what phone will be used with his product. Therefore, the chances are overwhelmingly against obtaining results from such a horn.

A horn that will work moderately well with a phone having a 2⅛-inch diaphragm, will not always work with a phone that has a 1¾-inch diaphragm, etc. The moral, therefore, is that manufacturers of horns should not put them out alone in any case whatsoever, but furnish the phones or other electro-magnetic appliance built into the socket of the horn itself. This would be the only way to get fair results.

And while we are on the subject of horns, we want to call to the manufacturers' attention that 90 per cent. of them are not only designed wrong from start to finish, mechanically, but most of them have no acoustic properties whatsoever. The size and shape, acoustically, are wrong, and the materials themselves are ill-chosen. You cannot expect a thin, tin horn to give anything but a tinny sound, which, in fact, it does. We have seen horns when used with phones that started to vibrate at their fundamental stage, giving off a note of their own, and you can imagine the noise that issued forth from such a horn, instead of music. The materials are usually entirely too thin, and if metal is used it should never be less than 1/32 inch in thickness.

We know that to get rid of the tinny sound it would be better not to use metals at all, but try to obtain a substance that gives no rise to overtones and no bad echoes. Years ago a phonograph horn was made of a sort of cardboard substance, lined with a thin coating of felt. This horn reproduced sounds better than anything we have seen lately.

Another material which might be used is cork in some form. Even a metallic horn lined with cork would be preferable to the present-day horns.

Finally, it becomes important to dwell upon the size of the diaphragm used in connection with loud-talkers. A number of manufacturers satisfy themselves by choosing almost any type of horn and attaching it to a single telephone receiver, letting it go at that. That is not solving the problem. Even if the horn was properly constructed mechanically and acoustically, we would still have the problem of the telephone itself. We venture the opinion that the size of most of the telephone diaphragms used today is much too small. It has been found in actual practice that a telephone receiver with a diaphragm from 2 inches to 2⅛ inches in diameter gives the best results. While it is true that the telephone receiver having a diaphragm of about 1¾ inches will, in some cases, give a louder sound, it is also, as a rule, much shriller, and does not reproduce the human voice, band concerts, etc., as well as a larger diaphragm. Always remember that for broadcasting work a diaphragm is not only called upon to reproduce the human voice, but musical instruments as well. We are of the opinion that a small diaphragm cannot do this. For this reason the Germans use much larger telephone diaphragms, the size being almost three inches. Much better results are had with such receivers for broadcast work. Our manufacturers would do well to look into this, and if they can produce something that will give perfect, or nearly perfect, reproduction they will change the whole aspect of the radio industry, and people will buy radio equipment as they have never bought it before.

H. GERNSBACK.

Radio Equipment at KDKA

By D. G. LITTLE*

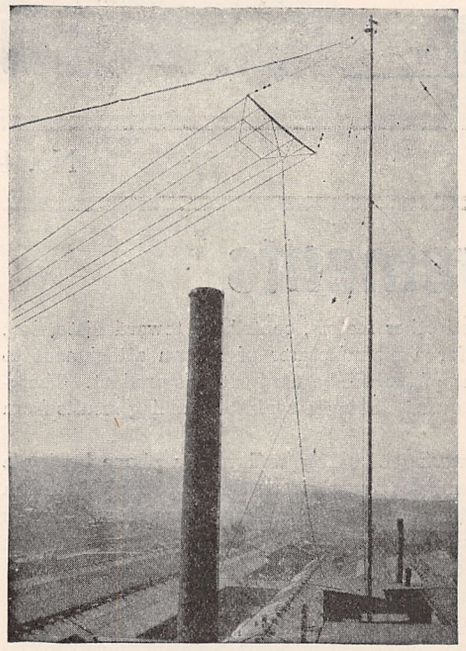


Fig. 5—Concerts and the Daily Programs Radiating from This Antenna System Have Been Received at Distant Points in Both North and South America. KDKA's Success in Broadcasting is Due Greatly to the Efficient Antenna Employed.

WITH the increasing popularity of radio broadcasting, a description of station KDKA will be of interest to the general public, a large number of whom are already acquainted with the station through their receiving sets. KDKA opened November 5, 1920, with the broadcasting of the presidential election returns that day. It is therefore believed that this station can claim the honor of being the first radio telephone broadcasting station operating regularly and exclusively for the entertainment and education of the public. Since December, 1920, daily evening programs have been broadcasted. The programs have been enlarged from time to time to include educational talks by prominent men, sporting returns, concerts from Carnegie Music Hall and other similar places, acts from theaters, and church services Sunday morning and evening, with radio chapel Sunday afternoon. In addition to the above, stock and produce market reports from the local produce market and from the New York Stock Exchange, together with weather reports and relayed time signals from the Arlington radio station, are being broadcasted daily.

The power of KDKA was at first relatively small, on the order of 100 watts being delivered to the antenna. In August, 1921, the range of the station was increased by improving the height of the antenna and raising the power output first to 500 watts and subsequently to 1,000 watts.

In keeping with the growth of the station, a special studio was arranged for the artists and announcer, particular attention being given to the acoustic properties, so that echoes, reverberation and other disturbances have been largely eliminated. The quality of transmission from this station has been improved at every opportunity by means of the studio, and by improvement in the apparatus. The usual carbon microphone has been replaced by a condenser type transmitter for picking up the sound waves. Resistance coupled amplifiers are employed for increasing the relatively weak output of the pick-up transmitter to a power sufficient to control the radio set. The natural oscillating frequency of all the units in the pick-up and amplifier system has been placed, so far as possible, outside of the audio frequency range, so that the radio signal is practically a perfect reproduction of the original sound. Special filter circuits are arranged to eliminate generator hum in the power supply to the radio transmitter. As broadcasting becomes less a novelty and more a practical form of entertainment, the high quality of KDKA's programs is being greatly appreciated by the audience. After over a year of operation this audience is very exacting as to the quality of reproduction and arrangement of the programs. It is necessary to secure the very best of talent and to keep the radio apparatus in the best possible condition.

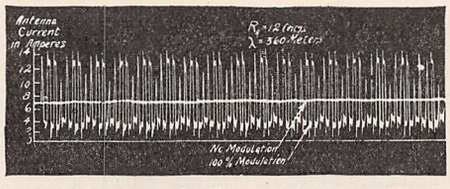


Fig. 4—Above is an Oscillogram of Antenna Current Taken When the Announcer was Speaking Loudly into the "Pick-up" Transmitter.

The path of the speaker's voice from the studio to the receiving station is shown in diagrammatical form in Fig. 1. The sound wave picked up by the transmitter in the studio, theater or church is amplified before it is transmitted by means of a telephone line to the radio station, where it is further amplified and used to control the output of the radio transmitter. The radio transmitting set is supplied with power directly from the work's power plant through a step down transformer for the vacuum tube filaments and through special motor generator sets, which change the 220 volts direct current to 2,000 volts direct current for the tube plates.

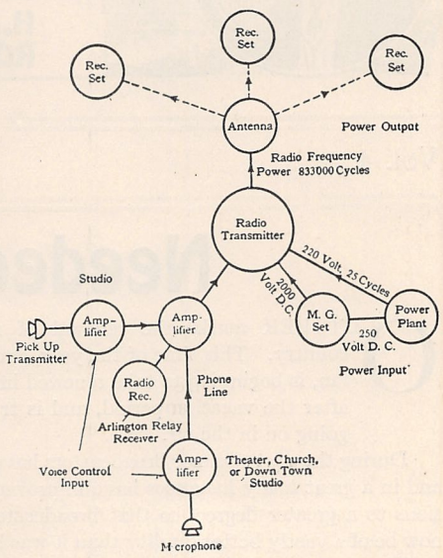


Fig. 1—Method by Which Music and Voice Pass Through the Various Sections of the Broadcasting Stations Transmitter on Their Way to the Receiver is Shown Here in Diagrammatic Form.

The radio transmitter changes this power from 2,000 volts direct-current to alternating-current power at a frequency of 833,000 cycles per second (360 meters wave length), which is supplied to the radiating system, consisting of an antenna and counterpoise. This high frequency power in the antenna system sets up waves in the ether, which travel outward in all directions and, intercepting the receiving antenna, set up voltages and currents which operate the receiving sets.

A general view of the radio transmitter now in use at KDKA is shown in Fig. 2. This set furnishes about one kilowatt high frequency power to the antenna. Fig. 3 shows the power circuit diagram. This section carries only direct current at 2,000 volts and low-voltage alternating current at 25 cycles. This 25 cycle current is used only for heating the filaments. To prevent any of the 25 cycle current being superimposed on the grid-filament and plate-filament circuit, the return of the grid circuits and the 2,000 volt circuit is connected to the midpoint of a resistor, which is shunted across the filament, each half of the resistor being shunted by a condenser for by-passing the radio and audio frequency circuits.

The four 250 watt power tubes in the upper part of the set are the oscillators,

(*Continued on page* 668)

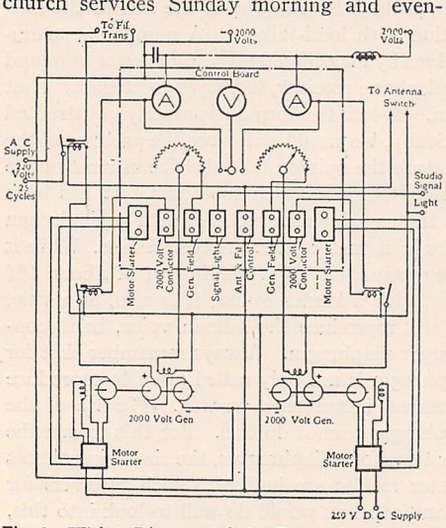


Fig. 3—Wiring Diagram of the Power Supply Unit. Plate and Filament Current for the Transmitter and Signal Light Supply are Provided. Only Direct and Low Frequency Alternating Current are Carried on This Panel. The Radio or High Frequency Energy is Limited to Its Own Switchboard.

**Radio Engineer, Westinghouse Electric and Manufacturing Company.*

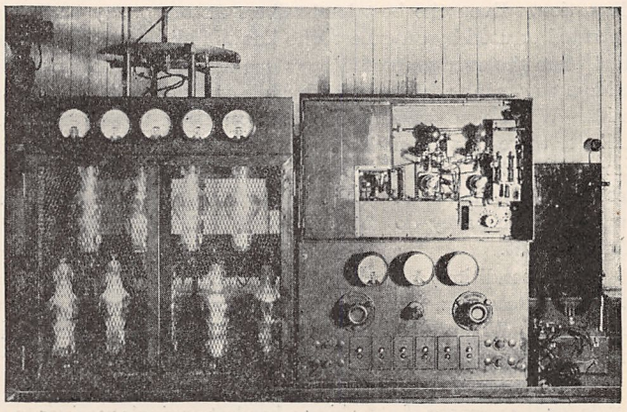


Fig. 2—A General View of the Radio Transmitter in Use at KDKA. The Meters at the Top Show the Operator How the Set is Functioning. From Left to Right They Are: Filament Voltmeter, Ground Current Meter, Plate Ammeter, Modulation Meter and Plate Voltmeter.

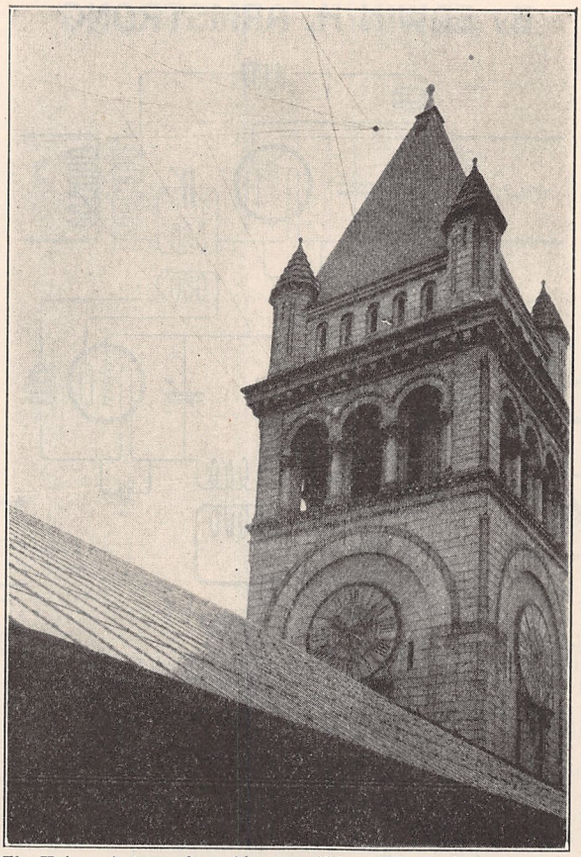
The Antenna Unique

By S. R. WINTERS

ANY arrangement or device for radiating or receiving electromagnetic waves may be labeled an antenna. It is probably the most flexible term in the lexicon of radio-telegraphy and radio-telephony. Structurally, an antenna may vary in size, from a modest coil or loop with a few turns of wire to sky-climbing towers, 1,000′ high, and a system embracing 10 square miles, the area covered by the high-power radio-telegraph station recently built near Port Jefferson, Long Island. The shapes of antennae are comparable to the proverbial "57 varieties." A fan, cage, umbrella, kite, inverted L, the letters T and V and a portable mast joined together like a commercial fishing rod, are among the common representations of devices for radiating or receiving electric waves.

According to a broad classification, the antenna systems resolve themselves into two classes—one serving chiefly in the capacity of electrical condensers and the other acting primarily as electrical inductances. The former classification adheres to the unmodified term of "antenna." The system acting chiefly as electrical inductances employs a variety of designations such as "coil antenna," "coil aerial," "loop," and "direction finder," when the quality of determining the direction of electromagnetic waves is uppermost for consideration. Still another distinction used is that of a "counterpoise antenna" or merely a "counterpoise," when a group of parallel wires elevated a few feet from the earth and insulated therefrom obviates ground connection. Strange formations, too, may be found in the construction of antenna systems. A device resembling a cage is especially serviceable in times of war; when the antenna is robbed of one or two of its wires it is still able to function. Trees have been employed as antennae, and in at least one instance an antenna system has invaded the wilderness, being effectively stretched across a gorge 3,000′ deep.

Classification fails, however, in designating the design of the antenna system in operation by the United States Post Office Department, hence the title of this article, "The Antenna Unique." In both construction and formation, it is the only one of its kind in the world. The massive structure, quartering the administrative personnel and equipment of our national and international postal service, has been converted into a veritable base for radiating and receiving electromagnetic waves. Barring the Washington Monument, it is the tallest structure in Washington, D. C., rearing itself upward for a distance of 315′. The roof of the building and the sky-climbing tower comprise the masts for supporting the antenna, the four strands of wire converging at the pinnacle of the tower. The arrangement may be said to partake of both the features of a conventional antenna and a counterpoise, employing the roof of the building as the "ground."



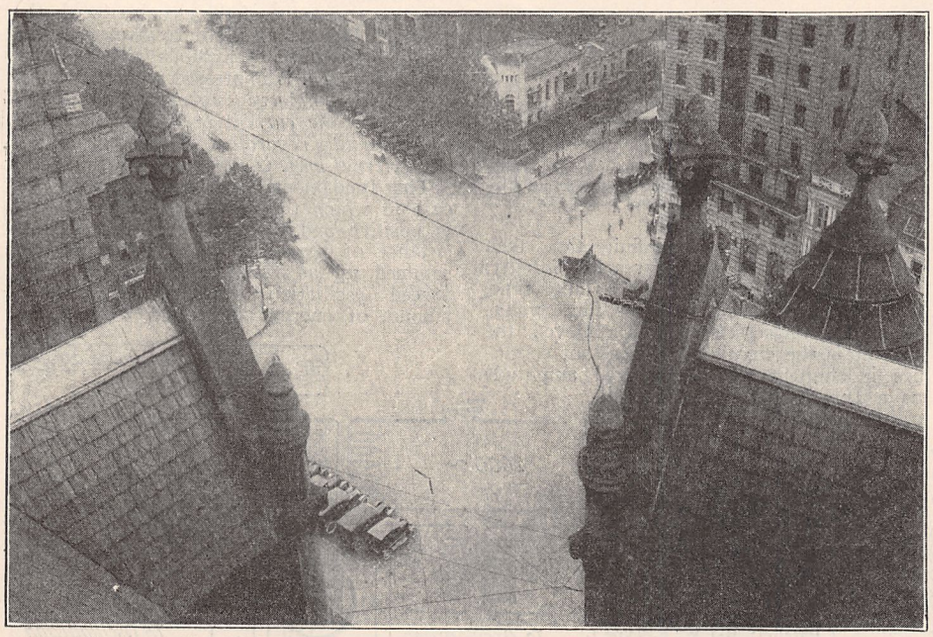
The Unique Antenna from Above. Although Erected at a Dangerous Risk to Life, No Mishap Occurred. WWX, the Washington Post Office Department, is Having Remarkable Success with the Aerial, Both in Transmission and Reception.

The writer, in company with J. C. Edgerton, in charge of the wireless service of the United States Post Office Department, and a local photographer, by ascending devious stairways scaled the heights of the structure proper to secure the photographs illustrating the antenna system. When standing atop of the roof of the building we were then 100′ or more below the top of the tower where the four groupings of wires converge. From this commanding position, the resourceful photographer tilted his camera downward to secure an image of the direct "lead-in wires" of the antenna where they obtain passage through a window to the radio-telegraph and radio-telephone apparatus on the eighth floor of the building. Then focusing the camera upward, an image of the tower, 315′ above the level of the street, was for the first time visualized. The tower was a subject readily lending itself to the searching eye of the camera lens, but the antenna wires were included in the picture by adroit manipulation of the image-visualizing machine.

The Post Office Department, instead of erecting masts to a height of from 600′ to 1,000′ to support an antenna system, has effectively utilized existing facilities. Moreover, the same quarters which house the Postmaster General and the administrative forces employed in directing the handling of Uncle Sam's mails likewise serve as the basis for a broadcasting service in disseminating market reports and directing the operation of the air-mail stations by wireless telephone and telegraph. This antenna system admits of both the transmission and reception of communications. The roof of the building which serves as a support for an antenna for transmitting messages also accommodates a receiving antenna. The carrying of the network of wires to the zenith of the 315-foot tower was without mishap, notwithstanding such an undertaking involved an obvious hazard to human life. The tower clears itself upward for approximately 100′ from the roof of the building, this distance being gradually scaled by a portable ladder affixed to the pointed bit of architecture.

Having descended from the dizzy height, on top of the roof of the Post Office Department building at the corner of Eleventh Street and Pennsylvania Avenue, from the mission of obtaining exclusive photographs of "The Antenna Unique," the writer reentered the radio room on the eighth floor just in time to hear a resonant voice saying, "Hello, hello, WWX is calling." It was C. A. Bauer, radio operator, beginning a real broadcasting service. The hour was 10.30 o'clock in the morning when a "marketgram" was being flung by means of radio-telephony through space to an invisible and unnumbered audience for hundreds of miles within a radius of Washington. This "marketgram," transmitted on a wave-length of 1,160 meters, is a report on the prices of fruits

(*Continued on page 672*)



The Difficulty of Placing the Aerial in Position May Be Fully Appreciated from This View. As the Building Itself Is 315 Feet High, No Masts Were Necessary.

Some Recent Developments of Regenerative Circuits*

By EDWIN H. ARMSTRONG

IT is the purpose of this paper to describe a method of amplification which is based fundamentally on regeneration, but which involves the application of a principle and the attainment of a result which it is believed is new. This new result is obtained by the extension of regeneration into a field which lies beyond that hitherto considered, its theoretical limit, and the process of amplification is therefore termed *super-regeneration.*

Before proceeding with a description of this method it is in order to consider a few fundamental facts about regenerative circuits. It is well known that the effect of regeneration (that is, the supplying of energy to a circuit to reinforce the oscillations existing therein) is equivalent to introducing a negative resistance reaction in the circuit, which neutralizes positive resistance reaction, and thereby reduces the effective resistance of the circuit. There are three conceivable relations between the negative and positive resistances: namely—the negative resistance introduced may be less than the positive resistance, it may be equal to the positive resistance, or it may be greater than the positive resistance of the circuit.

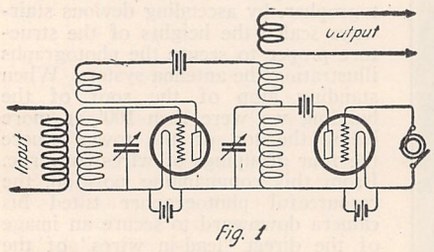


Fig. 1

We will consider what occurs in a regenerative circuit containing inductance and capacity when an alternating electromotive force of the resonant frequency is suddenly impressed for each of the three cases. In the first case (when the negative resistance is less than the positive), the free and forced oscillations have a maximum amplitude equal to the impressed emf. over the effective resistance, and the free oscillation has a damping determined by this effective resistance. The steady state is attained after the initial free oscillation dies out and continues until the impressed emf. is removed, when the current dies out in accordance with a second free oscillation. The maximum amplitude of current in this case is always finite; it reaches this maximum amplitude in a finite time, and when the impression emf. is removed the current dies away to zero. This is the action of the circuits which are now in every-day practical use.

In the second case the negative resistance is equal to the positive resistance, and the resultant effective resistance of the circuit is therefore zero. When an emf. is suddenly impressed in this case, the current in the circuit starts to increase at a rate which is directly proportional to the impressed emf.

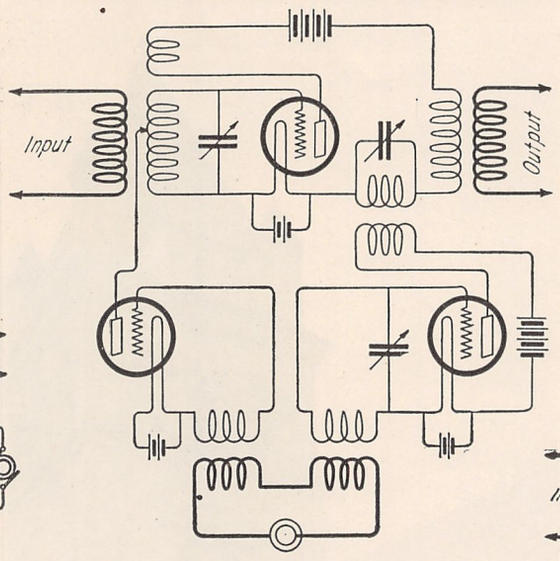


Fig. 3

These Three Diagrams Show the Three Different Methods of Producing the Super-Regenerative State by Varying the Relation Between the Negative and Positive Resistance of the Regenerative Circuit.

and to the square root of the ratio of the capacity to the inductance of the circuit (for a given impressed frequency). If the emf. is impressed for an infinite time, then the current in the circuit reaches infinity. If the emf. is impressed for a finite time, then the current reaches some finite value. When the impressed emf. is removed, the current in the circuit at that instant continues indefinitely with unchanged amplitude as a free oscillation. Theoretically, this is the limiting case for regeneration; practically, it is always necessary to operate at some point slightly below this state at which the circuits have a definite resistance.

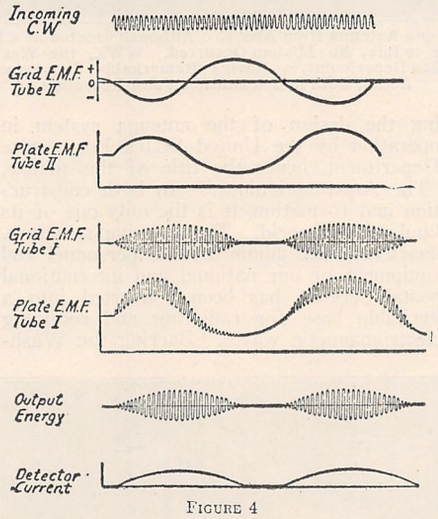


FIGURE 4

An Idea is Given Here of the Phenomena Which Occur When an emf. is Applied to the Input Circuit—in This Case, the Input of Fig. 1.

It is important to note here that although the circuit of this case has zero resistance, oscillations will not start unless an emf. is impressed upon the circuit; furthermore, that oscillations once started continue with undiminished amplitude indefinitely. This state cannot be attained in practice, because the negative resistance furnished by the tube is dependent on the amplitude of the current and for stable operation decreases with increasing amplitude.[1]

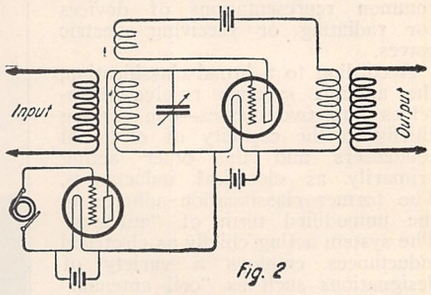


Fig. 2

In the third case the negative resistance introduced into the circuit is greater than the positive resistance, and the effective resistance of the circuit is therefore negative. When an emf. is impressed upon a circuit in this condition, a free and a forced oscillation are set up which have some interesting properties. The amplitude of the forced oscillation is determined by the value of the impressed emf. divided by the resultant resistance of the circuit. The free oscillation starts with an amplitude equal to the forced oscillation, and builds up to infinity regardless of whether or not the external emf. is removed. The free oscillation starts with an amplitude which is proportional to the impressed emf., and this proportionality is maintained throughout any finite time interval, with constant impressed electromotive force.

It is important to note that although the negative resistance of the circuit exceeds the positive, and the effective resistance of the circuit is negative, oscillations will not occur until some emf. is impressed. *Once an emf. is impressed, however, no matter how small it may be, the current in the circuit builds up to infinity regardless of whether or not the external emf. is removed.*

The fundamental difference between the case in which the resistance of the circuit is positive and the case in which the resistance of the circuit is negative may be summed up as follows: in the first, the forced oscillation contains the greatest amount of energy and the free oscillation

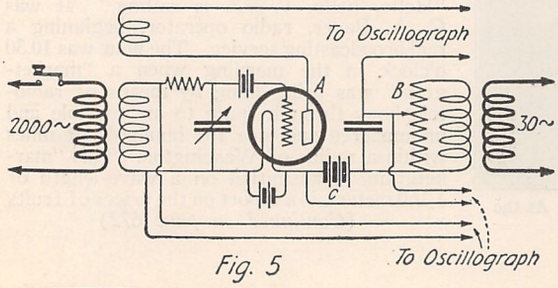


Fig. 5

The Oscillograms on the Next Page Were Obtained With the Apparatus in These Two Figures. Fig. 5, A-4 W. E. Type L Tubes in Parallel; B, AC Voltage—100 Volts; C, DC Voltage—160 Volts. Fig. 6, A-4 W. E. Type L Tubes in Parallel; B-1 W. E. Type L Tube With Grid and Plate in Parallel; C, DC Voltage—160 Volts; D, AC Voltage—30 Volts.

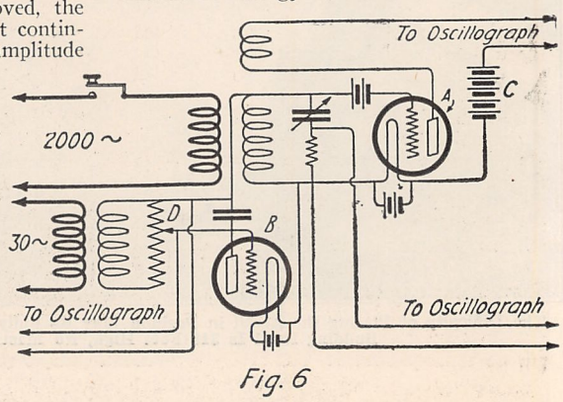


Fig. 6

*Abstract from the Proceedings of the Institute of Radio Engineers by permission.

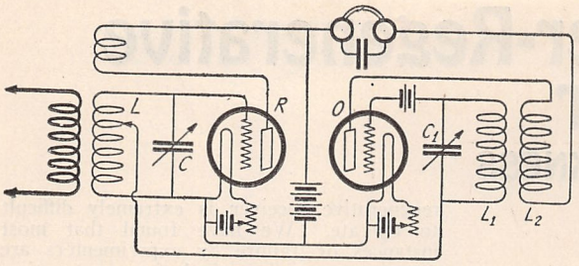
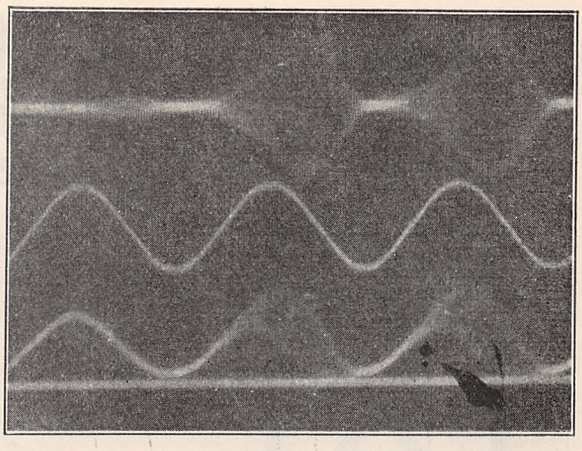


Fig. 12

Right: Oscillogram of the Current and Voltage Relations Existing in the System of Fig. 1 in Which the Negative Resistance is Varied.

Left: In This Circuit, the Oscillating Tube Acts as the Detector. This Can Only Be Done When the Frequency of Variation is Super-Audible.



is of very minor importance[2] (after a short interval of time); in the second, it is the free oscillation which contains the greatest amount of energy and the forced oscillation which is of negligible importance.

It is, of course, impossible with present-day instrumentalities to set up a system in which the negative resistance exceeds the positive without the production of oscillations in the system, since any irregularity in filament emission or impulse produced by atmospheric disturbances is sufficient to initiate an oscillation which builds up to the carrying capacity of the tube. It is, however, possible, by means of various expedients, to set up systems which avoid the production of such a paralyzing oscillation and which approximate the theoretical case in the use of a free oscillation to produce amplification.

It is the purpose of this paper to describe a principle of operation based on the free oscillation which is quantitative and without a lower limit. This new method is based on the discovery that if a periodic variation be introduced in the relation between the negative and positive resistance of a circuit containing inductance and capacity, in such manner that the negative resistance is alternately greater and less than the positive resistance, but that the average value of resistance is positive, then the circuit will not of itself produce oscillations, but during those intervals when the negative resistance is greater than the positive will produce great amplification of an impressed emf. The free oscillations which are set up during the periods of negative resistance are directly proportional in amplitude to the amplitude of the impressed emf. The variation in the relation between the negative and positive resistance may be carried out by varying the negative resistance with respect to the positive by varying the positive resistance with respect to the negative, or by varying both simultaneously at some frequency which is generally relatively low compared to the frequency of the current to be amplified.

These three methods of producing the super-regenerative state are illustrated respectively by Figs. 1, 2 and 3, which figures indicate the general scheme of the system and the methods varying the relation between the negative and positive resistance. Fig. 1 shows a method of varying the negative resistance produced by the regenerative system by varying the voltage of the plate of the tube by means of a second tube, the grid of the second tube being excited by an emf. of suitable frequency.

Fig. 2 illustrates a method of varying the positive resistance of the circuit with respect to the negative. This is accomplished by connecting the plate circuit of a vacuum tube in parallel to the tuned circuit of the regenerative system and exciting the grid by an emf. of suitable frequency. Fig. 3 illustrates a combination of these two systems in which simultaneous variations are produced in both the negative and positive resistances and provision made for adjusting the relative phases of these two variations.

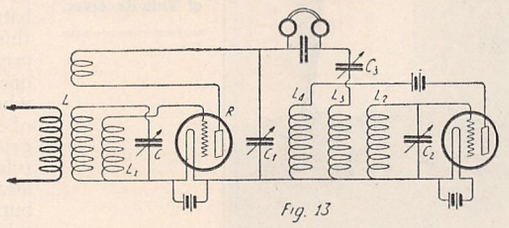


Fig. 13

When a Super-Audible Frequency of Variation is Used with the System of Fig. 1 it is Necessary to Introduce Resistance into the Tuned Circuit as Shown by L_1 in This Diagram.

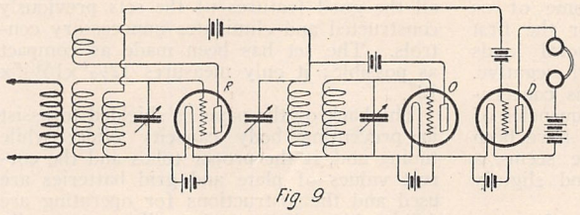


Fig. 9

Practical Application of the System of Fig. 1 for Varying the Negative Resistance. For Audible Frequency of Variation a Separate Detector Tube is Required.

A general idea of the phenomena occurring in these systems when an emf. is applied to the input circuit will be obtained from the diagram of Fig. 4 which applies specifically to the circuit of Fig. 1. This figure illustrates the principal relations existing in the system in which the positive resistance is constant and the variation is introduced into the negative resistance. It will be observed that the frequency of variation appears as a modulation of the amplified current so that the output circuit contains currents of the impressed frequency plus two side frequencies differing from the fundamental by the frequency of the variation.

Oscillograms of the essential current and voltage relations existing in the systems of the type illustrated by Figs. 1 and 2 were obtained with the set up of apparatus illustrated in Figs. 5 and 6, respectively. In the arrangement of Fig. 6, in order to produce sufficient variation in the positive resistance of the tuned circuit, which was of large capacity and low inductance, it was necessary to use a two-electrode tube in series with the auxiliary emf.

Figs. 7 and 8 are oscillograms respectively for a negative resistance variation and a positive resistance variation. The signaling emf. was impressed about half way along the film, the exact point at which the key was closed being indicated by the arrow. These oscillograms show phenomena which are in accordance with the explanations already given, but, in addition, show evidence of self-excitation. It has been stated in the preceding pages of this paper that the basis of super-regeneration was the discovery that a variation in the relation between the negative and positive resistances prevented a system which would normally oscillate violently from becoming self-exciting. An examination of the oscillograms will show that this is not strictly true, as a free oscillation starts every time the resistance of the circuit becomes negative. It will be observed, however, that this free oscillation is small compared to that produced by the signal, and therein lies the complete explanation of the operation of the system. The free oscillations produced in the system when no signaling emf. is impressed, must be initiated by some irregularity of operation of the vacuum tubes and must start at an amplitude equal to the amplitude of this disturbance. This initial value is of infinitesimal order, and hence, in the limited time interval in which it can build up the locally excited oscillation, never reaches an amplitude comparable to the oscillation set up by a signal of any ordinary working strength.

There is a second point of interest which is most evident from the curves of Fig. 7. It will be observed that there is a decided lag in the maximum value attained by the free oscillation set up by a signal and the maximum value of plate voltage (negative resistance) of the amplifying tube. This is most evident from the plate current curve. It is a point of considerable interest, and the phenomena involved will be analyzed in a later part of the paper.

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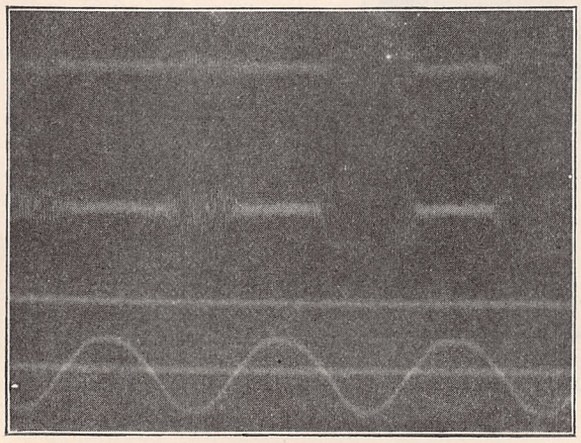


Left: Oscillogram of Current and Voltage Relations of the System in Which the Positive Resistance is Varied as in Fig. 2.

Right: Practical Application of the System of Fig. 2. The Positive Resistance of the Tuned Circuit is Varied by the Oscillations of the Second Tube.

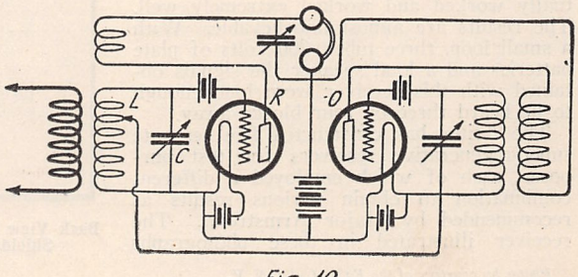
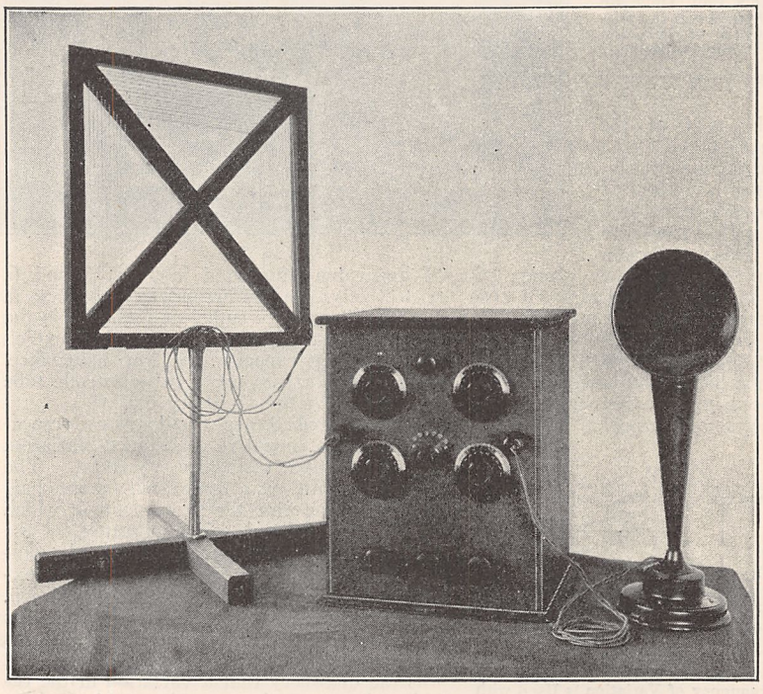


Fig. 10

Construction of a Super-Regenerative Receiver

By KENNETH HARKNESS



Front View of the Super-Regenerative Receiver, the Construction and Operation of Which Are Described in This Article. Radiophone Broadcasts Can Be Received Very Loudly with Three Vacuum Tubes by Means of This Receiver.

THE theory of super-regeneration has been pretty well discussed from every possible angle. Some of us have learned—possibly for the first time—that there are several kinds of resistances, positive, zero and negative. We have read lengthy discussions concerning audible and super-audible frequencies of variation. Complicated diagrams have been flashed before us and each one seems a little different from the last and slightly more difficult to understand.

However, just as the authors of recent simplified radio text-books all seem to have separately reached the inevitable conclusion that waves are formed when a stone is dropped into a pool of water, so the various writers of articles on super-regeneration seem to agree that the same amount of amplification formerly obtained with nine vacuum tubes can now be obtained with three tubes by means of this new method of reception.

This statement is so intensely interesting to the radio enthusiast that he naturally wants to know how to build a receiver of this type.

Undoubtedly a great many super-regenerative receivers, have been constructed but, for some reason, many of these fail to operate properly. This may be on account of improper assembly or the use of incorrect material. The super-regenerative circuit is very critical and the proper values throughout are essential. Another reason for poor results may be the inability of the operator to tune the circuit, or his lack of knowledge how to approach this.

The accompanying photographs show a super-regenerative receiver which has actually worked and worked extremely well. The results are almost unbelievable. With a small loop, three tubes, 200 volts of plate batteries and a loud speaker the signals obtained with this receiver were loud enough to be heard three or four blocks away.

The writer has constructed five separate super-regenerative receivers for test purposes, each of which employed a different combination to obtain various results as recommended by Major Armstrong. The receiver illustrated in these photographs represents the result of much experimentation in design and operation. It employs all the good features of the sets previously constructed and eliminates unnecessary controls. The set has been made as compact as possible; it only measures 12½"x16½"x 12".

The back of the panel is shielded to assist in preventing body capacity effect while tuning and, if the proper tubes and the correct values of plate and grid batteries are used and the instructions for operating are followed, excellent results will be very easily obtained by anyone.

It is a mistaken impression that the super-regenerative receiver is extremely difficult to operate. We have found that most instances of failure by experimenters are due to some minor fault in construction. However, one cannot expect to operate a super-regenerator in the same manner as a crystal receiver or a single-circuit tuner. Results will not be obtained by turning the dials round at random. The circuit must be tuned with care and intelligence and some knowledge of what is being accomplished by the various controls. This can best be obtained, of course, by studying the theory of super-regeneration. However, the same results can be obtained even by a novice if he follows instructions carefully.

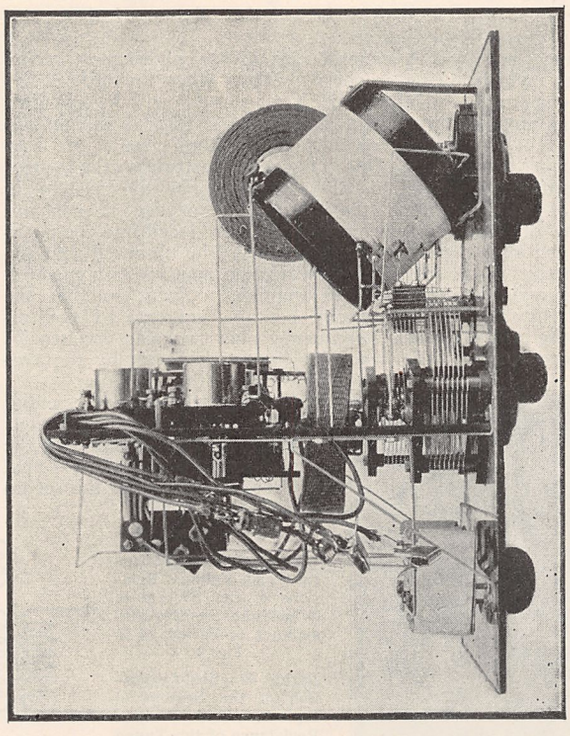
The circuit used in this receiver is given in Fig. 1. This is based on the circuit given by Major Armstrong in his lecture to the Radio Club of America. There is one point of difference—the location of the grid battery B3. By placing the grid battery in this position a negative potential is impressed on the grids of the first two tubes. The operation of this circuit is thereby somewhat simplified. Previous arrangements of super-regenerative receivers required two grid batteries, one for each of the first two tubes as shown in Fig. 2. This has some advantage when receiving tubes are used, but as best results are obtained with power tubes, the circuit of Fig. 1 was chosen as being simpler to operate. As a matter of fact, if the plate voltage is not over 200, the receiver will operate successfully with power tubes without any grid batteries.

However, by placing the grid battery as shown by B3 in Fig. 1, a negative potential is impressed on the grids of both tubes and greater amplification is obtained. The control is also greatly simplified. The potentiometer across the A battery provides a vernier control of the grid potential and this control is very useful in finding the critical operating point.

The values of the various apparatus of Fig. 1 are indicated in the caption and the arrangement is shown in the photograph of the back view of this receiver. L1 and L2 indicate the vario-coupler which is plainly in view in the foreground. Below the vario-coupler is the condenser C1. Behind the vario-coupler, mounted on the right hand side of the panel, is the condenser C2, to the back of which is attached the coil L3. Below these is the condenser C4 which is visible in the background of the photograph. The three filament rheostats are easily recognized at the bottom of the panel. It will be noted that the panel is carefully shielded with aluminum.

A shelf is held to the front panel by means of brackets. The shelf supports the three tube sockets, the filter circuit, and the coil L5, while beneath the shelf are suspended the audio-frequency amplifying transformer Tr and the coil L4 which acts as a radio-frequency choke. The leads with clips attached are to make contact with the grid batteries. The binding posts for the filament and plate batteries are mounted at the back of the shelf.

Referring to the photograph of the front of the receiver, the loop plugs in the jack on the left and the loud-speaker on the



Back View of This Super-Regenerative Receiver. The Panel is Shielded With Aluminum to Avoid Body Capacity Effect.

Photos by courtesy of the Radio Guild, N. Y.

right. The lower dial on the left controls the condenser across the loop and therefore changes the wave-length of the circuit. The dial immediately above this controls the feed-back of the first tube as it varies the position of the secondary of the vario-coupler. The potentiometer is controlled by the small knob at the top center of the panel. These three controls are practically all that are required to tune this receiver, after the proper positions have been found for the other two dials controlling the oscillation and the frequency of oscillation of the second tube. The grid, plate and filament batteries are connected to the back of the receiver, leads being brought through the cabinet with clips attached.

Most of the apparatus employed in this receiver are quite familiar while the special choke coils, resistances and vario-coupler are now obtainable from radio dealers.

The best type of tubes to use are the Western Electric E tubes. These are now obtainable. The values given for batteries are intended for this type of tube. It is possible, of course, to employ other makes of 5-watt tubes or even hard receiving tubes, but the values will be accordingly changed and we do not believe as good results will be had. In any case, soft tubes should never be employed in a super-regenerative circuit—they are quite useless. The battery B1 of Fig. 1 should be 100 volts and the battery B2 also 100 volts. This amounts to a plate battery of 200 volts, all of which is connected to the plate of the last tube, while a tap is taken for the first two tubes. The grid battery B4 is 22 volts and the other grid battery B3 is in the neighborhood of 7 volts. The latter value is variable.

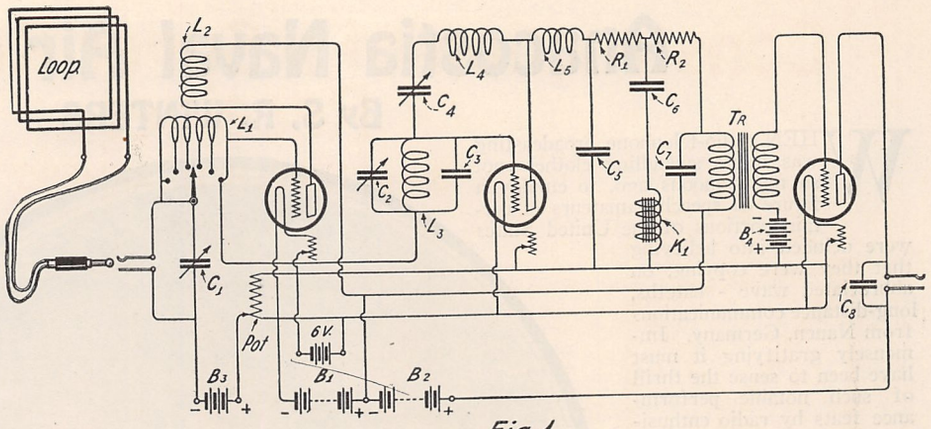


Fig. 1

This is the Hook-Up of the Super-Regenerative Receiver Illustrated in the Photographs. The Battery B3 is Used to Impress a Negative Potential on the Grids of the First Two Tubes. The Constants of the Apparatus in This Circuit Are as Follows:

L1, L2—Short-Wave Vario-Coupler, Secondary 100 Turns; C1—.0005 M. F.; L3—D. L. 1250; C2—.001 M. F.; C3—.002 M. F.; C4—.001 M. F.; L4—D. L. 250; L5—D. L. 1500; C5—.005 M. F.; R1, R2—12,000 Ohms Each; C6—.005 M. F.; K1—.1 Henry Iron-Core Choke; C7—.002 M. F.; Tr—A. F. Transformer; C8—.002 M. F.

OPERATING THE RECEIVER

When the filaments are lit a high-pitched whistle should be heard from the loud-speaker. This whistle indicates that the second tube is oscillating. If the whistle is not present the grid battery B3, the potentiometer and the condenser C4 should be varied to produce oscillation.

When the whistle is obtained, the feed-back coil L2 and the condenser C1 are varied to produce oscillation in the first tube. This point of oscillation will be easily recognized by the usual tests for oscillation.

With the first and second tubes oscillating, if the circuit has been correctly wired, a certain unmistakable effect will be noticed. If any of the variable elements of the circuit are changed, a series of heterodynes of harmonics should be heard. This indicates that the circuit is properly connected, although these harmonics will not be heard after the circuit is adjusted.

After this state has been reached, the rest of the tuning is easy. The wave-length of the station to be received is tuned by the condenser across the loop and by tapping the number of turns on the loop itself. Voice or music should be audible. The two dials at the right of the receiver should then be varied to obtain the maximum amplification. Usually these condensers need to be at about their maximum capacity. A condition will be easily found where the whistles of the harmonics are no longer audible and the speech or music is received clearly. Final tuning with the grid battery and potentiometer will find the critical point.

No matter how explicit the instructions may be, undoubtedly the best method of operating the super-regenerative receiver is

(*Continued on page* 682)

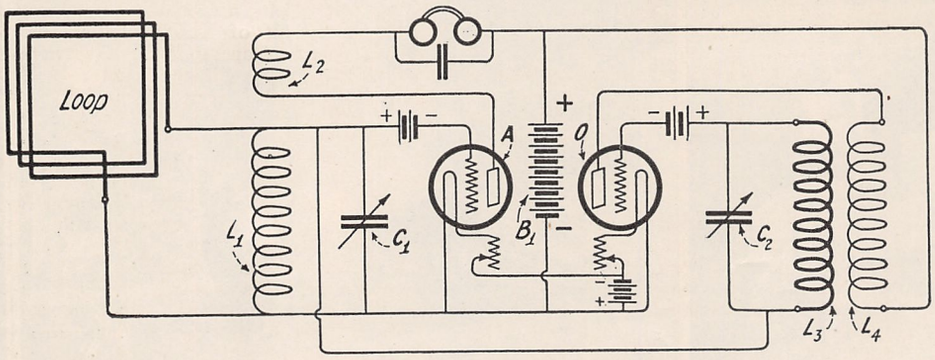


Fig. 2

In This Diagram of a Two-Tube Super-Regenerative Receiver a Grid Battery is Used for Each Tube. When Power Tubes Are Used These Can Be Omitted or the Arrangement Shown in Fig. 1 Adopted in Their Place.

Earlier Days in Radiophone Broadcasting

By CHARLES GILBERT*

So much interest is being shown in the beginning of radio broadcasting, in the present awakening of public interest in the radio art, and so many inquiries are being made regarding the pioneer broadcasting of Dr. Lee de Forest that it might be well at this time to put down a few of the historical dates in the development of this notably American art.

It is interesting to know that the first broadcasting of music was not by means of the phonograph so generally used at present. The spring of 1907 saw the radio distribution of synthetic electrical music, generated and played in a building at the corner of Broadway and 37th Street, New York City. The plant itself consisted of many inductor alternators whose frequencies were those of the entire musical scale. Music furnished by this electrical organ was transmitted by wire to nearby theaters, hotels and restaurants, where one or several loud horn speakers poured into the ear this new electrical music. To connect this musical current into radio frequency and impress on the antenna, which was erected for this purpose on the roof of this building by Dr. de Forest, was comparatively simple, and thereupon the demonstrations were made for the receiving stations in New York City. The experiment in broadcasting, however, lasted but a very short time.

The location of what may properly be described as the first actual radiophone broadcasting station of the world, however, was in the old Parker Building, 19th Street and Fourth Avenue, New York City. On the top floor of this building was the laboratory of Dr. Lee de Forest; two flag-poles on the roof of this building furnished the necessary support for the antenna. It was in the same little old laboratory that many months earlier the inventor had tested out his first three-electrode vacuum tube. Unfortunately, this historic laboratory which saw the birth of the Tiny Glass Baby, which was known as the modern Aladdin's lamp, is no longer in existence. In January, 1908, a great fire completely destroyed the Parker Building, incidentally wiping out of existence note-books and many precious samples of the earliest audion bulbs.

The first actual transmission of phonograph music, let it be known, was the result of experimental tests by Dr. Lee de Forest in 1907 on some twenty small telephone transmitters planned for installation on Admiral Evans' battleships and destroyers, prior to their historic round-the-world cruise.

The first actual application of the De Forest radiophone in reporting a news event was no doubt the reporting of the yacht races on the Great Lakes in the same summer of 1907; gramophone music was then furnished between the spoken bulletins.

In the operatic season of 1908-09, there was a temporary installation of a radiophone broadcasting station on the roof of the Metropolitan Opera House in New York City. Microphones concealed among the footlights of the stage, connected with the transmitting station, then gave the first radio opera in the history of the art. Among those who were able to listen in at that time were the radio operators on the ships in New York Harbor.

The first opera artist to sing directly into the microphone of a De Forest radiophone transmitter was Madame Mazarin,

(*Continued on page* 684)

President and General Manager, De Forest Radio Telephone & Telegraph Co.

Anacostia Naval Air Station

By S. R. WINTERS

WHEN radio-telephone broadcasting was in its swaddling clothes—not so many moons ago, to employ a figure of speech—amateurs in certain portions of the United States were deluded into believing that they were copying, on abbreviated wave - lengths, long-distance communications from Nauen, Germany. Immensely gratifying it must have been to sense the thrill of such notable performance feats by radio enthusiasts whose receiving sets are to them tokens of the magical wand. And, it may be cruel, even at this late date, to prick the bubble of faith, but in doing so this writer establishes a rack on which to hang a tale!

Messages from this high-power German radio-telegraph station were really in circulation, but their availability to amateur stations was made possible by a rebroadcasting system in operation at the Naval Air Station, Anacostia, District of Columbia—or "NOF," to designate it by call letters familiar to the wireless fraternity. Radio-telegraph signals from Nauen, Germany, were "picked up" by "NOF" on a wave-length of 12,600 meters and distributed to amateur stations within a radius of hundreds of miles of the National Capital on a wave-length of 250 meters. This incident, heretofore disguised to those who may have credited their receiving instruments with erratic performances or superior achievements, is related as an indication that the Naval Air Station at Anacostia is calculated to spring agreeable surprises periodically. A 100 per cent. experimental radio laboratory that it is, "NOF" is not pledged to cut-and-dried performances. Unconventional ways of broadcasting are its privilege. Moreover, it is a radiating storehouse for that delightful broadcasting feature, music of the United States Marine Band.

The Upper View Shows the Operating Room of NOF. Below on the Left Is the C. W. and Phone Transmitter, While on the Right Are the Receiving and Control Apparatus. NOF Sends on a 412-Meter Wave-Length.

Commander Stanford C. Hooper, chief of the Radio Division of the Bureau of Engineering, United States Navy Department, in a statement recently, indicated that the number of persons participating in the pleasures derived from the musical entertainments of the Marine Band would be swelled into an invisible audience of millions. Moreover, it is likely that the concert that is given on the grounds of the White House or in a park anywhere in the National Capital—some distance removed from Anacostia—will be audible to the occupants of an isolated rural home or to the city-dweller many hundreds or even a thousand miles from Washington. Portable apparatus, carried from place to place with quite the facility that the peanut vender carts his parched underground product along with the floating crowds, has been acquired by the Bureau of Engineering of the Navy Department. Just as the law follows the American flag, this traveling unit, at the request of the President or Secretary of the Navy, may be installed at public exercises or other functions. Once installed, the entire performance will be relayed to Anacostia and from there broadcasted to the entire invisible audience within the transmitting range of this station. The wave-length employed will be 412 meters. Similarly the exercises will be relayed to Arlington and radiated from "NAA" through space on 2,650 meters. The system is a duplicate, in miniature, of that introduced at the dedicatory exercises of the Lincoln Memorial, whereby both visible and invisible audiences participated in the ceremonies.

"NOF" likewise contemplates the installation of equipment whose objective will be to impinge music or vocal speech on electromagnetic waves so effectually that their reproduction, in all their purity, will be assured at any point within the receiving range of this broadcasting station. Toward this end, special sound-reproducing apparatus has been purchased for installation at Anacostia, displacing the experimental units now in service. Perfect reproduction of all sound waves, is the appraisement made in behalf of the newly-acquired instruments. The installation was placed into service August first, and in the future the public will be enabled to hear music and other concerts flung into space from this point in the absence of jarring notes or distorted effects of the true sounds as they are originally uttered. The experimental concerts of past months have not only afforded entertainment to an audience reckoned as being approximately 200,000, but have served as an index whereby the reliability and effective range of the radio-telephone may be considerably advanced.

As the designation implies—Anacostia Naval Air Station—"NOF" is primarily a research laboratory devoted to studies affecting the problems arising from the use of wireless apparatus on board air craft. With the exception of a laboratory maintained by the Air Service of the United States Army at McCook Field, Dayton, Ohio, the Naval Air Station across the Anacostia River from the War College in the National Capital is doing distinctive investigational work. It is the pioneer Government enterprise of its kind in the United States, and possibly in the world. It was established in 1918, the building being designed to serve the particular needs indicated. A squatty structure, approximately 100′ long and 40′ wide, facilitates the movements of air craft in proximity to the building. Outside of the main structure are two or three wireless receiving stations, as well as a pretentious compass station. Commander A. Hoyt Taylor is in active charge, working under the supervision of the Bureau of Engineering of the United States Navy Department.

With the exception of "WGY," the broadcasting station of the General Electric Company at Schenectady, "NOF" is the highest powered radio-telephone broadcasting station in the United States. It was among the first stations to inaugurate a broadcasting service, and was the pioneer Government station to recognize the demands of this increasingly popular feature. At present, the Marine Band gives a concert each Wednesday evening and the Navy Yard Band performs each Friday night. Since

(*Continued on page 728*)

A Radio Romance

By RAY FROST

THE tremendous, world-wide interest in radio has brought to at least one man the realization of the dreams of a lifetime.

Nathaniel Baldwin, a devout Mormon, was the inventor, ten or a dozen years ago, of a highly sensitive telephone receiver, but until the advent of radio broadcasting, never experienced the least difficulty in meeting the demand for his instrument at his little hillside factory on the outskirts of Salt Lake City—that is, when he was able to raise the money for material. Now he is swamped, buried, overwhelmed with orders.

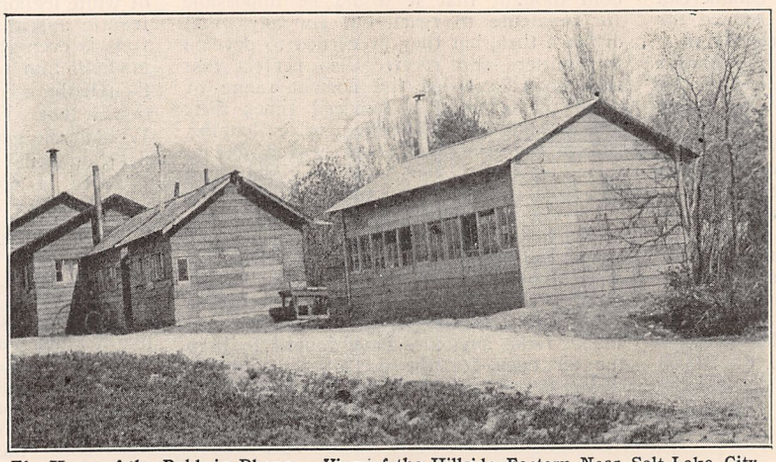
From every state in the union, every civilized country, the farthest islands of the sea, orders for Baldwin's radio headsets have poured in until there are now on file in his shanty office unfilled demands for more than 200,000 pairs.

Baldwin's modest plant lies against the base of the Wasatch Mountains, 23 oversize Salt Lake blocks to the east of the Mormon temple, and 35 to the south.

A lane, jammed with the motor cars of his employees, runs above his plant, which has been added to from time to time, until it now extends down the lot in a long row of narrow wooden buildings. A roaring mountain stream runs past the workroom windows at one side, and at the opposite windows the fragrance of peach and apple trees drifts in. One is struck with the thought that here in this clean and airy sunlight would be a good place to work.

Baldwin, the man, is a product peculiar to the region in which he has been born and reared, modest to the point of diffidence. In his office is a drafting table in lieu of desk, and two or three plain chairs. On the table are the Book of Mormon, Doctrine and Covenants and Pearl of Great Price, standard works of the Mormon faith. The covers of these volumes harbor no dust.

Baldwin leans against the drafting table and smiles in a guarded, friendly fashion as he talks. He was born at Fillmore, Utah, in 1878, and as a boy set out on foot for Provo, 120 miles away, on the chance of finding an opportunity to work his way through Brigham Young University. He had no money for fare nor tuition, and was none too well clad, but the boy whose name was destined to become so well known in the future world of radio, worried about those things not at all. He knew nothing of luxurious travel or life without hard work, and all he asked was a chance to earn his way.



The Home of the Baldwin Phone. View of the Hillside Factory Near Salt Lake City, Where Nathaniel C. Baldwin Supervises the Manufacture of His Phones.

To some, Provo might have seemed a small and uninteresting town, even though it lay between the dimpling fresh waters of Lake Utah and the base of lofty Timpanogos, with the giant Indian figure lying flat on its back along the crest, but to young Nathaniel it was a golden city of Baghdad. Among its enchanted streets he wandered in the heat of midday, and before the sun had set had found a place to live in exchange for a few hours of work morning and evening.

In due time he graduated from the school, and having earned and saved sufficient money to take him to Palo Alto, in California, repeated the process at Leland Stanford, Jr.

The world looked bright when, at the age of twenty-six, he returned to B. Y. as Professor of Physics, but the end of his second year in that capacity saw him dismissed and discredited in the eyes of his fellows.

Brigham Young University is a church-controlled institution, and after several warnings, the authorities had seen fit to discipline Baldwin for a lack of discretion in his discussions of a certain ancient principle which it had seemed best to abandon. The leaders of the church had declared against the continuation of plural marriages, and the instructor had failed to temper his remarks in accordance with their directions.

A period of bitter struggle followed for

(*Continued on page* 724)

Broadcasting From San Francisco

By OLIVER W. TUTTLE

"KUO"—the radiophone broadcasting station of *The San Francisco Examiner*—is the Big Brother to every radio fan in the West.

Located on top of the Hearst Building, Third and Market Streets, this station serves a multitude in the western states and brings cheer and entertainment to thousands in remote sections.

Not alone because of its power and extensive radiation is KUO a favorite with the radio public, but its popularity is also gauged by its variety and extensive programs of concerts and other data broadcasted.

Early last March this station spun into its initial activity. Previous to its birth, scant attention was given radio telephony by the general public. True, many thousands possessed receiving sets, but the wave of enthusiasm was not manifest.

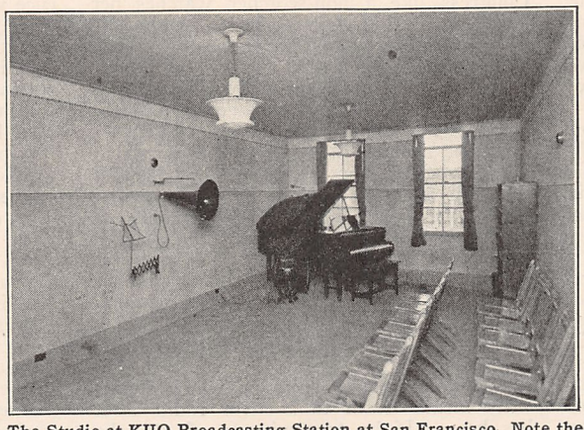
The Examiner, realizing the possibility of serving further the public by the use of radio, established KUO. This was only after an exhaustive survey of radio and all its details, which continued over a period of many months.

A radio page was established in the newspaper with the advent of its broadcasting station, and suddenly the public pulse was awakened to the possibilities of this new scientific wonder. Practically over night the "craze," as it has been termed, swept the west and now every home and office is in the market clamoring for receiving sets.

Radio dealers frankly declare that the activity of *The Examiner* was the greatest single stroke for radio in the western states, and through the enterprise of that newspaper radio has been made a part and parcel of the life of western citizens.

Every day KUO broadcasts to its vast army of listeners-in. All anxiously await its entry on the air to get late news bulletins, baseball scores, weather and crop reports, the summary of the financial market and the extensive concert or other music.

KUO has many achievements to its credit. For instance, the following wire was sent by C. M. Rice, Jr., Worcester Mass., and speaks for itself: "I heard KUO radiophone San Francisco on detector, without amplifiers, about April 23, four afternoons in succession and one night afterwards. The conditions were very bad, but I managed to hear the music quite clearly. My set consists of three honeycomb coils and two variable condensers and four stages of audio frequency amplification. My aerial is about 225' long. San Diego in the south, and Seattle in the north and ships 1500 miles at sea have all reported picking KUO up perfectly."



The Studio at KUO Broadcasting Station at San Francisco. Note the Signal Light Above the Microphone. This Light Instructs the Performer.

This broadcasting station conducts a service unusual in scope. On 485 meters it serves the official U. S. weather forecast three times a day. This is vital to the farming districts of the great Pacific Slope and is likewise all important during the winter season to the mariners off the Coast. On 525 meters it conducts a direct service to the pilot boat, cruising 10 miles off the Golden Gate, delivering to the navigators who board the ship entering the harbor, necessary information as to the arrival of craft, and instructions to the pilots, which is an aid to navigation. This service is looked upon as a big facility to the port of San Francisco, as well as an aid to commerce. It is likewise a safety measure in time of distress in that prompt assistance can be given craft any distance away.

Concerts, news, stock quotations and

(*Continued on page* 726)

Is the Radio Amateur Doomed?

By ARMSTRONG PERRY

UNTIL about a year ago practically one hundred per cent. of the American radio users, aside from persons in government or commercial radio services, were "radio amateurs." A radio amateur at that time was, actually or potentially, a member of the body in which the ideals of his kind took form and authority, and which, according to its own statement, is: "A national non-commercial organization of radio amateurs, bonded for the more effective relaying of friendly messages between their stations, for legislative protection, for orderly operating, and for the practical improvement of short-wave Radio Communication."

Today, the percentage of "radio amateurs" as compared with other radio users has nearly or quite lost its two ciphers, dividing it by 100. The amateur, once alone in his fascinating field, finds himself jostled and trampled upon by a horde of common folks who want to hear a concert or something—that's all. He is in about the same predicament as an aristocratic old family when a real estate operator surrounds the ancestral estate with a development full of $4,000 houses. He is just as heroically trying to maintain the old traditions and live the old life, and with about the same chance for success.

The fact is, admit it or not, that radio communication between individual and individual is no more adapted to the new order of things than the town meeting type of government is adapted to our national affairs. A few friends could chat by radio and had a perfect right to do so while there was enough room in the ether for all who wanted to use it. But, since ninety-nine per cent. of our population cannot be expected to keep silence while one per cent. use the air for their personal pleasure, private intercourse by radio, in spite of present refinements of apparatus, will kill itself by overgrowth just as surely as the apple tree that hangs its branches so full of apples that they break.

The only possible event that can save the old order of things is the invention of a means whereby a radio message may be sent from one station to another without being heard at any station where it is not wanted. Occasionally the newspapers herald such an invention. Those who use radio would be glad to believe these reports, but few radio experts appear to place any reliance upon further increase of the traffic in the air than can be effected by enlarging the number of available wave lengths, and that increase is very limited as compared with the demands of a population of 110,000,000.

In some respects it is a pitiable situation. The radio amateur has been responsible, directly and indirectly, for developing radio to a point where all of us may enjoy it. Usually he has been a jump or two ahead of government and commercial systems because he has had more freedom. In a government system the money for experimentation comes tardily through Congress, whose first question sometimes seems to be: "What effect will this have on the election?" In a commercial system the question is: "Will it pay?" All the amateur asks is: "Will it work?", and in trying to answer this question he will hock his shirt or trap skunks or do anything else that will yield the necessary shekels to buy one more piece of apparatus.

Government officials chuckled, it is said, when they passed a law restricting amateurs to a wave length of only two hundred meters and a limited amount of power for transmission, so that they could not interfere with government and commercial stations while sending personal messages. Officialdom thought that it would be impossible for amateurs to reach out for any great distance then, but they proceeded to develop transmitters and receivers so perfect that they soon exceeded the normal range of great plants using a hundred times their power and more effective wave lengths. Before the American public was awake to their activities, the amateurs had shot messages across the continent. Then they put a few across the Atlantic. Today some of the bunch, like Hastings of Washington, nonchalantly call up Catalina Island or any other good place on the other side of the country whenever they want to compare notes with other bugs.

The radio amateurs have fought to keep the air open for the use of the common people. Long before the man on the street suspected that there was even a danger of his losing his fundamental right in the air to the far-seeing corporations that are always ready to assume control of natural resources, the radio amateur was watching Congress like a hop-scotcher watches her deadly rival, and if it stepped over the line in proposed legislation there was war until it stepped back again.

As has been said of so many other organizations and groups, the amateurs saved the country in the World War. Whatever questions may be raised about the part that others played, there can be no doubt that the radio amateurs actually did save the day. Radio was new, but vitally important. It cannot be learned in a day. The number of operators and experts in the government service was but a small fraction of the needed personnel. The ranks of the amateurs were the only source of supply. They did the job. All that is a matter of authentic history.

And now arises a situation which apparently means death to amateur radio as it has been. If he transmits as of old, the amateur is assailed by listeners who do not know nor care what message he tried to send nor where he tried to send it. They were hearing a concert and he butted in. There are thousands of them and only one of him. *Raus mit!* Let him try to listen to a distant station and his ears are filled with the voice of the phonograph in the shop down town; the admonitions of health experts to keep his head cool; the prices of white leghorn eggs and spring wheat; the frantic appeal of someone whose face he feels is even worse than her voice and who implores him for radiographic osculation, as though there could be any possible satisfaction in that. How would you feel about it? Would you get up on your hind legs and fight, or would you quietly lie down and die?

There is nothing submissive about the radio amateur except his ideal of what the other fellow ought to be when amateurs want the air. Whatever his age, he always has the spirit of youth and the way he lambasts every hostile head that comes over the horizon makes the war in Ireland seem like a Sunday-school picnic.

The "radio amateur" is as far from admitting that there is any other non-professional radio user who deserves the appellation as the Daughters of the American Revolution are from admitting Margot Asquith. A magazine that calls those who use crystal detectors for listening to concerts "radio amateurs" receives letters from small boys aged ten to ninety, who write from R. F. D. routes in forty-eight states and tell the editor for the love of Mike to cut out that stuff and learn to discriminate.

Some radio amateurs assume that the air belongs to their group, that it is theirs to give and theirs to take away. Says one of them:

"In Boston broadcasting means WGI (American Radio and Research). At the time of the convention, February, 1922, WGI had the distinction of being the oldest and worst high-power broadcaster. The Boston amateur hated WGI with all his heart and, naturally, refused to let it have the air."

In the same letter he said, after explaining that the amateurs had protested and that WGI had improved:

"The Boston Executive Council voluntarily gave up the hours from eight to ten, exclusively, to broadcasting. This generosity can be better appreciated when one considers that 95 per cent of our interference with the broadcast listener is due to his utterly wretched receiving equipment and not at all to our transmitter."

This amateur, an adult who has been an outstanding figure in radio for many years, continues his comments on the apparatus used by the radio public in this interesting fashion:

"Most of the novice (radiophone listener) sets sold today (May, 1922) would have been obsolete in an amateur station about 1908. Their tuning ability is zero, and to quote Mr. Warner, 'in our humble opinion, they are not worth a good lively damn. . . .' And in spite of these things we are making a present of the cream of the evening to these folks in Chicago, Washington, Boston and several other leading cities."

The league officially, with prophetic vision worthy of its strong, national leadership, has conformed to the new conditions. The

(*Continued on page 740*)

THIS article is one of the important of the year, as far as the radio amateur is concerned. We are glad to see that Mr. Perry has come to the same conclusion regarding the technical radio amateur as the Editor.

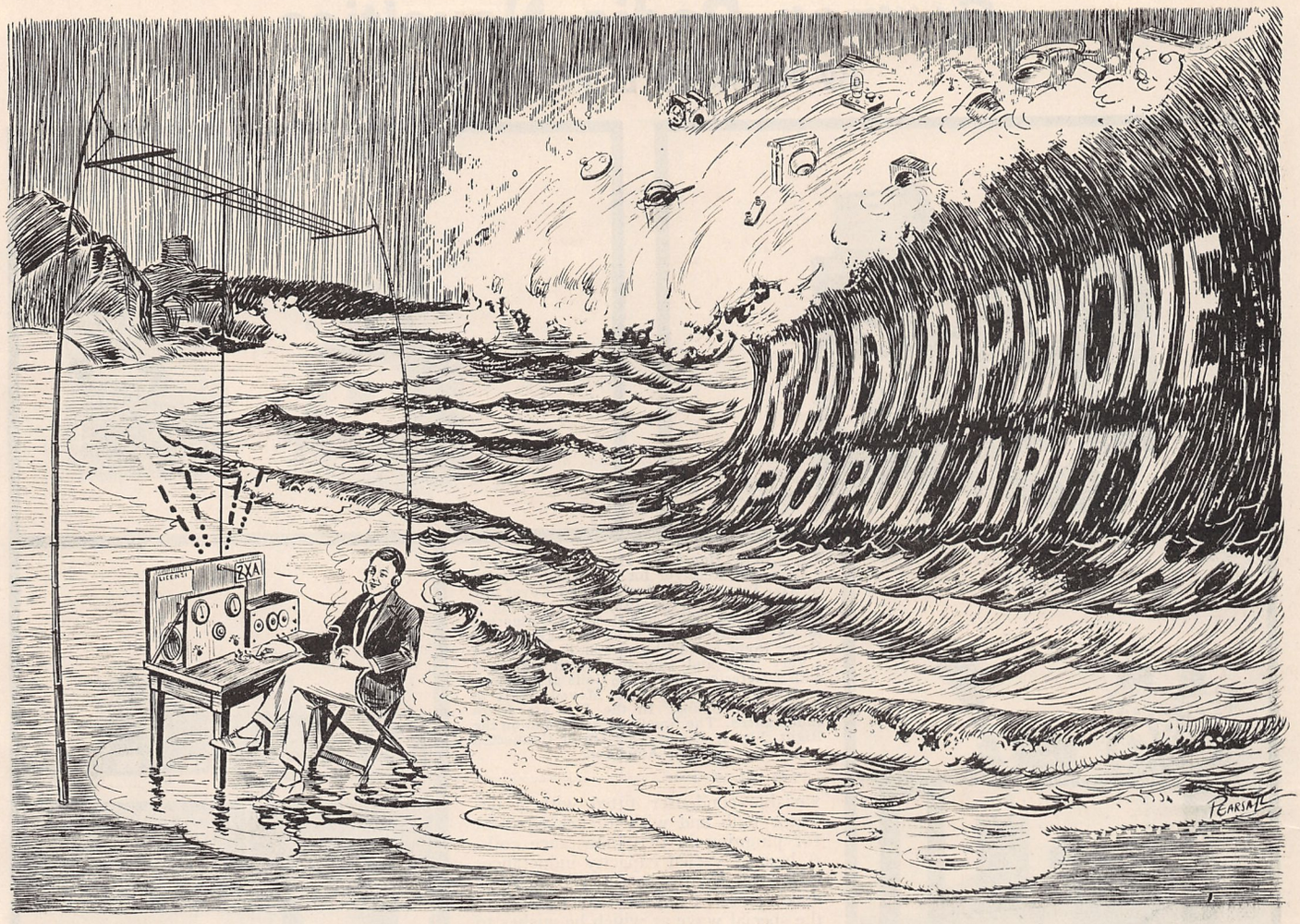
Time and again we have pointed out the same thoughts which are contained in Mr. Perry's article, particularly in our "Correspondence from Readers" Department.

Of course we are fully aware of the fact that the radio amateurs will let loose a war whoop that will be heard from coast to coast. We shall be flooded with letters from the old-timers, telling us, in unmistakable language, just what they think of us. We are prepared for it, and we shall be glad to publish the letters, brickbats and all, as is our custom.

If, however, the amateur will look the situation squarely in the eye, and face the emergency with spirit, and if, then, he will take Mr. Perry's excellent advice, the radio amateur will be saved.

At the present time the technical radio amateur is like a lone man standing in front of the beach, trying to stem the tide. In this case, the tide is the public. If the radio amateur does not move with the times, the public tide will surely swamp him out of existence.

Now is the time to think and organize. That is Mr. Perry's message.—Editor.



Who Will Save the Radio Amateur?

$500.00 Prize Contest

Radio News' Greatest Prize Contest

By H. GERNSBACK

THE radio amateur and the radiophone public have arrived at the cross-roads. There is no denying that, as far as the ether is concerned today, the public has full sway. In a country where the majority rules, the radio amateur is becoming engulfed, and his very existence is threatened. If we admit that there are 50,000 radio amateurs, there are or will soon be millions of radiophone fans.

As may be known, the writer has always been with the radio amateur. Himself an amateur from the start, his sentiment, as well as his sympathy, is naturally with the amateur. Lately he has been criticized in some quarters as having changed RADIO NEWS from an amateur periodical to a radiophone publication. Whether this is true or not is left to our readers to decide. Anyone who will look through RADIO NEWS with an impartial mind can speedily convince himself whether all the articles are on radiotelephony or are for the amateur as well. We would much rather let RADIO NEWS talk for itself.

At the same time we are face to face with a condition today which is clearly brought out in the accompanying article by Mr. Armstrong Perry. *The amateur is doomed unless something is done to get him out of the present rut.* The writer has no quarrel with anyone, or any organization. He is working for the good of the amateur, and particularly the amateur experimenter, but the point he wishes to make is that *the amateur today is not recognized in the community.* The public does not know him. For some reason he must be a poor advertiser. Sending messages to one another, relays, etc., which, while satisfactory to the amateurs themselves, **gain the community nothing.** The upshot of it is that all the present time-allocations are reserved for the broadcasting stations, and to the amateur are left the wee hours of the morning for his C. W. work. **There is today no real purpose for the radio amateur.** He simply regards radio as a sort of sport, and in many cases does not realize the great and wonderful utility of the art.

$500.00 in Gold

First Prize	$200.00
Second Prize	100.00
Third Prize	75.00
Fourth Prize	50.00
Seventh, Sixth, Fifth Prizes, each	25.00

There is a parallel between the "professional" radio amateur and the amateur photographer. When photography was young photographers took pictures for pay and otherwise. Suddenly the boom of amateur photography came along with the result that there are today more pictures being snapped each day by the public than the commercial or business photographers snap in a year.

Did the wave of amateur photography swamp the professional photographers out of business? It certainly did not! They are just as strong today as ever, and perhaps more so. Why? *They are rendering a distinct service to the community, for which they are getting paid.*

The writer does not mean to say in all this, it is necessary that the "professional" radio amateur should be paid for the service he renders in the community, but such a thing is not quite so unthinkable as it may be considered in some quarters. If the technically-trained amateur performs a service he should be paid for it; only if he does not perform the service in the community can he do without pay. The writer is not arguing for or against this. It is simply a thought, worthy perhaps, of consideration by our best amateurs in the country.

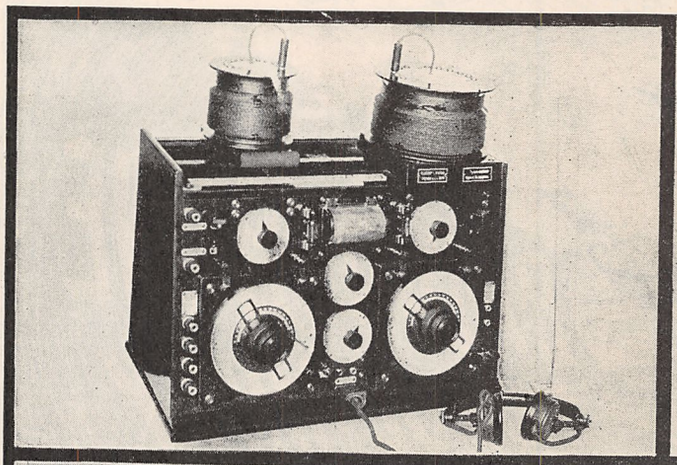
The writer has certain ideas of his own as to what the radio amateurs should do in order to become a great force in this country. Mr. Armstrong Perry, in his article, has expressed some such ideas.

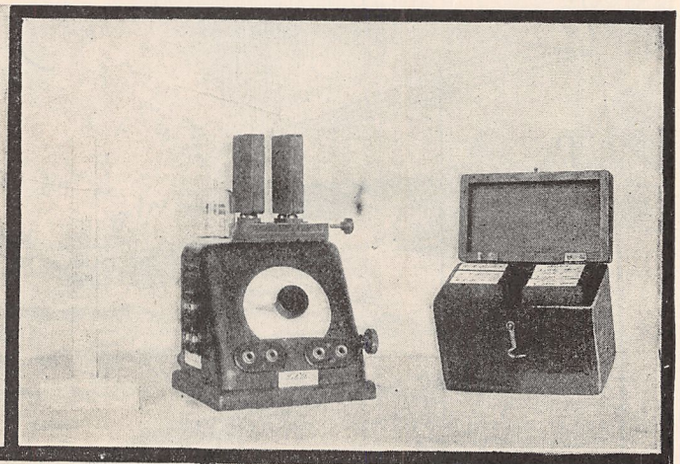
The writer, however, believes it best to let the amateurs themselves talk, and he is willing to start the ball rolling by offering $500 in prizes for the best suggestions as to how to bring this all about. Perhaps some of the amateurs have ideas that can be worked out, and that will do the trick, and

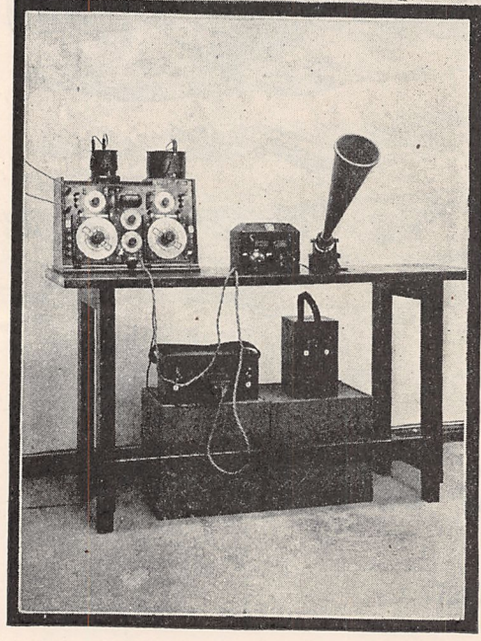
(*Continued on page* 795)

German Radio Novelties

By MAURICE E. PELGRIMS







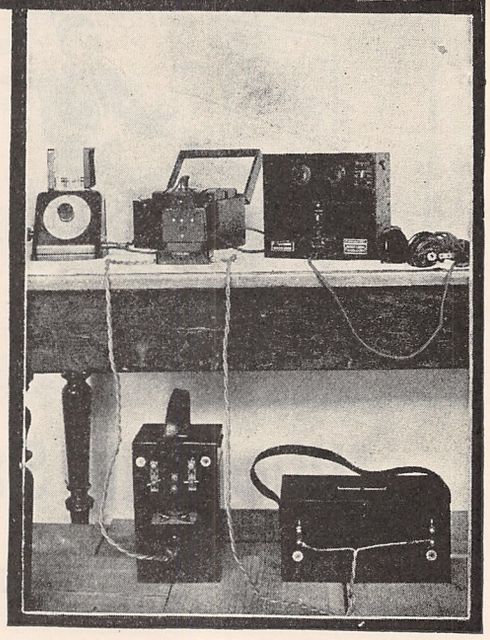


Fig. 1, in the Upper Left-Hand Corner, Shows a Universal Receiver for All Wave-Lengths. Special Tapped Coils Are Used to Cover the Whole Range from 165 to 25,000 Meters. Fig. 2, Below, Shows This Small Receiver Connected to an Amplifier and Loud Speaker. The Upper Right-Hand Photograph, Fig. 3, Shows a Very Neat and Compact Outfit Equipped with a Detector Tube. The Coils are Mounted Pancake Style and are Moved Apart to Vary the Coupling. In the Box are Extra Inductances. The Smaller Photograph on the Right, Fig. 4, Shows This Outfit Connected to an Amplifier.

IN the accompanying photographs an unusual design of radio apparatus which is manufactured at present by the well-known German Telefunken Company is illustrated. The primary and secondary inductances consist, as may be seen, of odd-shaped wire drums provided with plug-in contacts, the latter in lieu of the customary tap switches. This type of inductance is being made for tuning on various scales of wave-lengths, in the same manner as the honeycomb coils in the United States, from 165 meters to 25,000 meters. Note the manner in which the coupling between the primary and secondary is varied (Fig. 1). The secondary coil slides in a special groove on top of the receiving cabinet and a hard rubber grip fitted thereto makes allowance for the altering of the position of the coil. A pointer indicates the degree of coupling at any time. The condensers are also of the unit-type and may be removed and replaced by others of lesser or higher capacity as may be required. The two audion bulbs are protected by a screen in the upper center of the panel. The weight of the instrument is approximately 29 pounds.

Another type of instrument which is no less interesting and noteworthy is the one illustrated in Fig. 3. This, it may be said without undue exaggeration, has a fair claim to originality. Roughly described, it consists of a variable condenser fitted with a detector bulb and with an arrangement for plugging in two inductance coils. A box of varied capacity inductances is provided with the set, the operator making use of any two coils suited to the special wave at which he wishes to receive. The phone, battery, and the aerial and earth connections are obtained by plugging same in their respective places. Coupling is made possible by sliding the secondary in the frame provided. Fig. 4 shows one of these sets used in conjunction with a three-step amplifier; it differs a little from the first one described in that the ordinary inductance coils are replaced by variometer coils, both primary and secondary. Note the manner in which the variometer effect is obtained. Fig. 5 shows the same set as Fig. 4, used in conjunction with the substantially constructed commercial receiving coupler. In this case, of course, the purpose of the small set is to enable the operator to secure extremely fine adjustments, as well as to provide a larger reception wave scale.

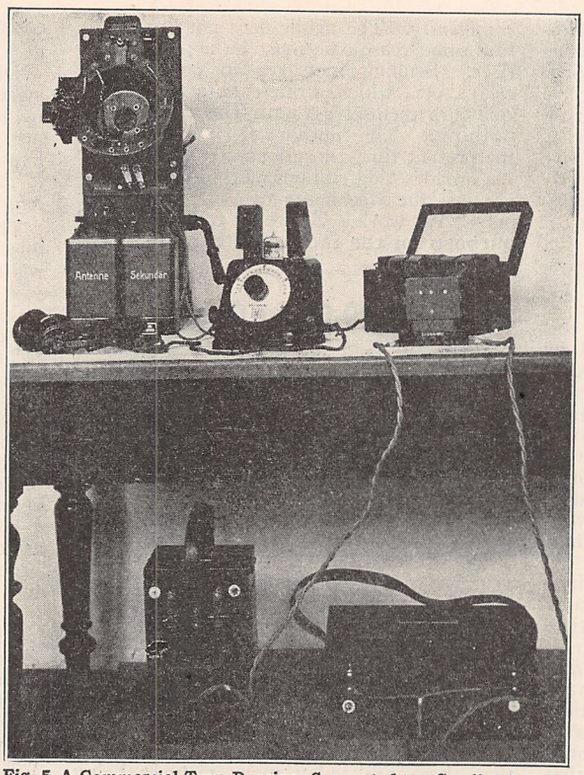


Fig. 5, A Commercial Type Receiver Connected to a Smaller Apparatus Which is Used as a Vernier for Fine Adjustment. The Detector Tube on the Small Outfit is Used with a Larger Receiver.

It may prove of interest to the American amateur that the Germans are maintaining, in general lines, the mode of construction of former years. The idea of the condenser set is clever, nevertheless.

POSTAL RADIO PLANES

While the radio work of the Department of Commerce, Public Health Service and Bureau Educational Services may be more instructive, the plans of the Post Office for aiding its transcontinental mail pilots by radio, especially in night flying, is by far the most interesting. Fourteen flying fields, stretching from Hazelhurst, Long Island, across the country to San Francisco, are already equipped with radio telegraph and telephone service for broadcasting, and all mail planes will soon be fitted out with radiophone sets capable of transmitting 125 miles. This maximum communication distance is sought in order

(*Continued on page* 738)

Who's Who in Radio

No. 20. MARIUS LATOUR

MR. MARIUS LATOUR was born October, 1875, in the southwestern section of France. He was educated at the University of Paris and Parisian Ecole Superieure d'Electricité, and was for many years consulting engineer to the General Electric Company of America; he was the author of numerous inventions in the world of electrodynamics. Mr. Latour paid special attention to the construction of high-frequency machines, which he originally attempted to design in the shape of monophase or polyphase machines grouped in cascade. He analyzed the essential features of machines based on this principle and showed their analogy and close relationship to those of Professor Goldschmidt.

The well-known system of reception of continuous waves by beats was introduced by an original paper presented by Mr. Latour to the Technical Manager of the General Electric Company at Schenectady in 1904. In this paper he set forth the principle of this method of reception, which is in general use today.

Mr. Latour has particularly specialized in the development of low and high frequency amplifiers for radio telegraphic reception. As far back as 1905, Mr. Latour, in conjunction

MR. MARIUS LATOUR

with Weintraub, had conceived the idea of utilizing the negative resistance of a specially designed mercury vapor tube for purposes of amplification. This vapor tube had a mercury cathode and two anodes. Under these conditions, Weintraub and Latour found, experimentally, that the potential drop between the cathode and one of the anodes for certain values of current decreased when the current increased. When the tube was introduced into a circuit containing a source of alternations, the weak current generated by the source was amplified because the negative resistance of the tube tended to balance both the positive output resistance and the internal resistance of the source. It was not until 1907 that the three-electrode tube amplifier was introduced by Dr. Lee de Forest.

Mr. Latour also perfected a system of multiple-wire telephony with high-frequency currents which was a development of the work of Maurice Leblanc in 1891-93.

During the war Mr. Latour designed the amplifiers which were used by the French Signal Corps. These were particularly of the audio-frequency type.

At present Mr. Latour is engaged in completing the work of constructing a new high-power station near Paris in which alternators of the Bethenod-Latour design will be used.

Broadcasting to the Ships at Sea

By CLAUDE CATHCART LEVIN

WILL certain Ocean liners be the broadcasting stations of the sea? Will the passengers of smaller liners dance to the music furnished by one of the big Ocean greyhounds? The prospect seems more than likely.

A few months ago, the United States Shipping Board's new passenger steamer, "Centennial State," now the "President Adams," bound from Queenstown, Ireland, for the United States, was able to entertain the officers and passengers aboard by tuning in a concert broadcasted from the S. S. "George Washington," some 200 miles distant.

The "George Washington," KDCL, after tuning his radiophone transmitter to a high degree of efficiency, announced to all within hearing that several individual selections would be sent, followed by the music of the entire ship's Orchestra.

For about an hour those listening in were entertained by the beautiful music being played aboard the "George Washington." The "Centennial State," KDRL, and the "New Amsterdam," PEB of the Holland American Line, acknowledged after each selection by radio telegraph on 450 meters. Long before the program was concluded the radio room of the "Centennial State" was crowded with an interested group of ship's officers and returning travelers and that of the "New Amsterdam" must have been the same because, after it was announced that the last selection would be given, she asked for a few more—"by special request of the lady passengers aboard."

After the selections, the leader of the Orchestra of the "George Washington" announced that it had given great pleasure to his musicians to be able to entertain the Ocean audience and that they hoped to be able to arrange for another such concert before the ship reached New York. Owing to the greater speed of the "George Washington," we on the "Centennial State" did not hear any more of the radiophone, although she may have used it when out of our immediate range or when we were busy with telegraph traffic on another wave. The entertainment was concluded by messages of greeting and congratulations exchanged by the various ships on behalf of their commanders.

That Ocean travelers will soon begin to demand entertainment by means of radio broadcasting is a foregone conclusion. At best, an Ocean voyage is a tedious though restful affair. Only the large Transatlantic liners have orchestras aboard. Add to the number of travelers on the ships without orchestras, the men of the crews of the freighters in their lonely life of traversing the Ocean lanes and we have the population of a good sized city eagerly waiting for entertainment.

And who can deny that the value of broadcasted lectures, sermons, concerts, etc., is increased three fold in the estimation of the crew of a lonely ship bound from Australia to America or by the passengers on a slow coaster beating her way up from South America. It is a repetition of the problem of furnishing press news to the ships at sea which has been solved by radio telegraph broadcasting from high power stations throughout the world.

With ships fitted as they are at present for radio-telegraph reception, which is supposedly equal for radiophone reception, why can the people aboard not enjoy the broadcasted programs? This is possible, but not to the fullest extent. For one thing, the usual standard of commercial receiver is designed to work best on commercial wavelengths and, with the constant increase of continuous wave telegraphy, the tendency is to design the tuners for a maximum of efficiency on wave-lengths of about 2,500 meters and upwards, rather than lower wavelengths. At the present rate of development, spark-telegraphy will soon become only an auxiliary means of communication. Even with the present standard apparatus fitted on Shipping Board and other vessels, two receivers are usually installed, one for short waves which ranges up to approximately 600 meters and another for long-wave work having a range of 1,000 to 10,000 meters and over.

The average ship's antenna at present is not ideally adapted to receiving on short waves, having too large values of inductance and capacity. Operators attribute to this fact the poor reception of 360 meter broadcasts.

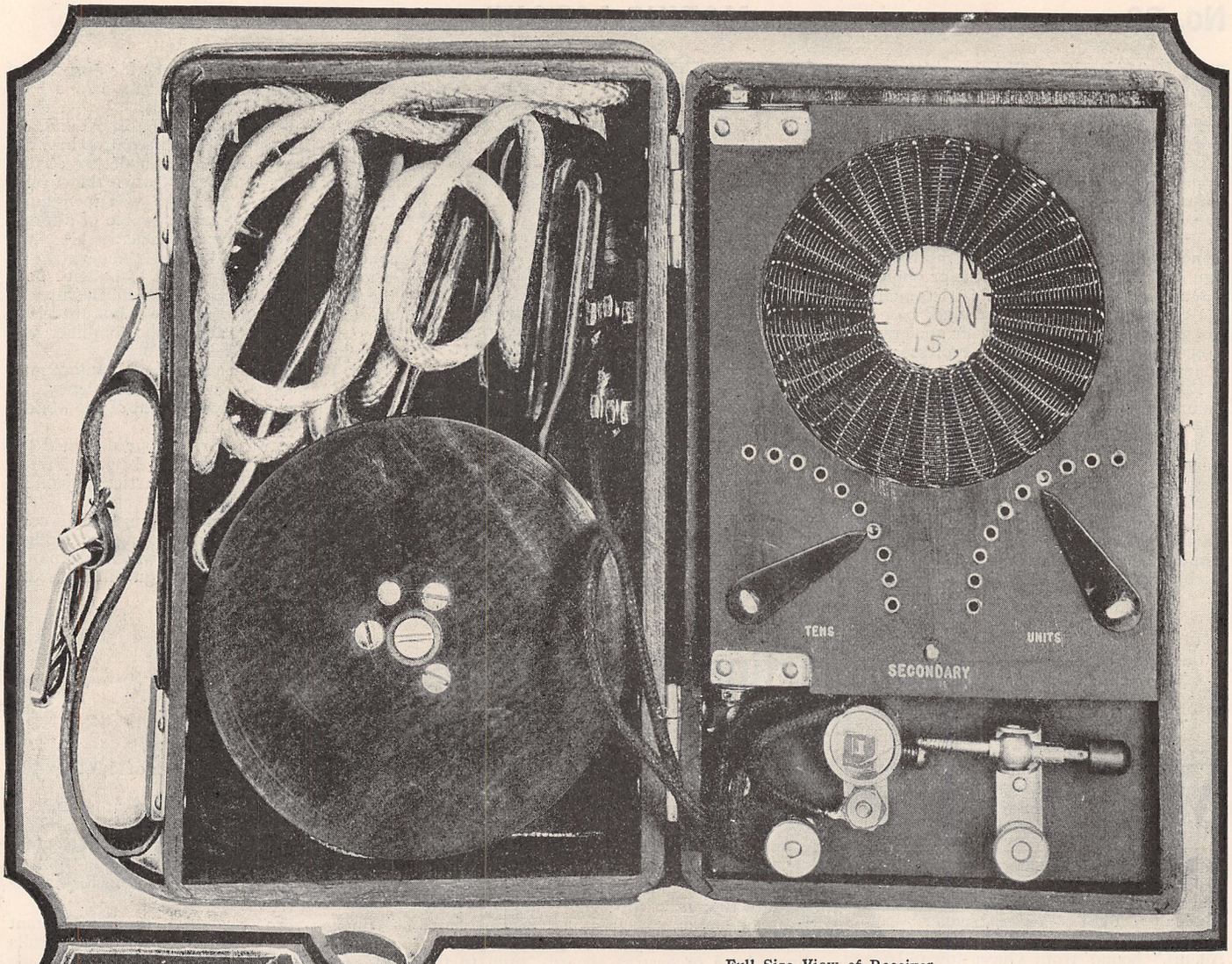
Furthermore, on ships to-day, constant watch must be kept on 600 meters for calls and possible signals of distress. Leaving this wave-length for any reason except, possibly, to get traffic off on some other wave, is fraught with great danger. A ship sending signals of distress might not be answered by another ship in the vicinity because the operator was engaged in receiving a jazz program on another wave and did not hear the calls for help.

Passengers take their shore habits to sea with them, having a tendency to turn ships into floating hotels and cities. As the demand for the reception of radio programs becomes insistent, these problems will be speedily taken up and solved. It has already been announced that the "Leviathan" will be fitted with a radiophone receiver in each room so that the occupants may enjoy the concerts. This undoubtedly means a pair of head phones, working from a power amplifier receiving impulses from a highly sensitive tuner in the main radio room. With such equipment, and one or more receiving tuners for short-wave reception, together with suitable switches and wiring for connecting a concert to the music room, a lecture to the social hall and perhaps stock reports to the Turkish bath where the shocks can be more readily absorbed, the radio room will in reality become the telephone exchange of the sea.

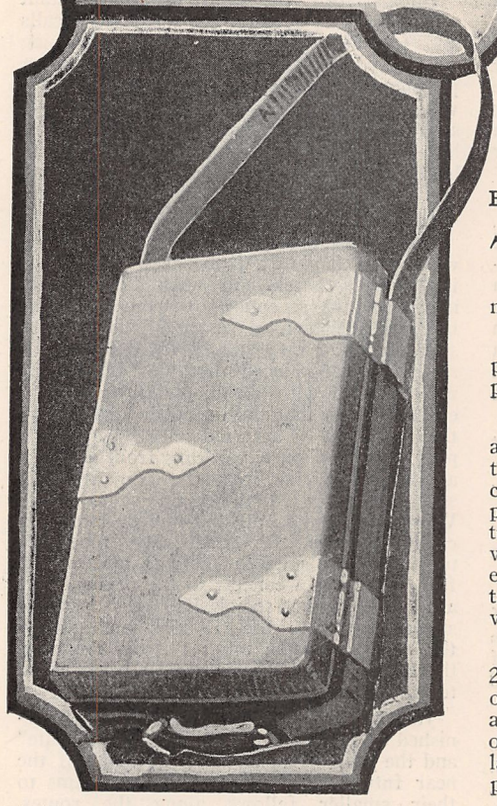
Just as the "George Washington" furnished a concert for the "Centennial State" and the "New Amsterdam," so ships of the near future will be furnishing programs to their smaller fellows along the routes. Societies, which now devote their time and energy to making things pleasant and bene-

(*Continued on page* 728)

Awards of the $375 Pocket Radiophone Contest



Full Size View of Receiver.



The First Prize-Winning Entry Has the Complete Aerial and the Ground Lead on One Side and Loose-Coupled Crystal Receiver on the Other. Closed, it is a Very Compact Unit and Easily Portable.

First Prize

A Practical Portable Receiver

By PAUL F. SHIVERS and JOHN R. STARK

THE accompanying crystal pocket set was designed and constructed by us to be entered in the Prize Contest announced in your August issue, 1922.

This set, as you will see from the enclosed photos and also from the model, is complete except for the head set or phones.

The tuning coils, primary and secondary, are mounted on panels which are hinged so that the coupling may be varied. The panels carry the tuning switches, two on each panel, controlling the inductance by single turns. The coils themselves are of spider-web construction, there being two webs to each coil. Each coil consists of 100 turns tapped at each ten turns, except the last ten, which are tapped every turn.

The case, which has outside dimensions of 2″ x 4″ x 6½″, carries the crystal detector of the cat-whisker type, the reel for the antenna, which consists of more than 150′ of fine braided copper wire, the antenna insulators and the ground wire and grounding pin.

The antenna insulators are equipped to act as dead end insulators and as anchors for the antenna and lead in. The dead end

Prize Winners

First Prize $150

PAUL F. SHIVERS and
JOHN R. STARK
℅ Webster Electric Company
Racine, Wisconsin

Second Prize $100

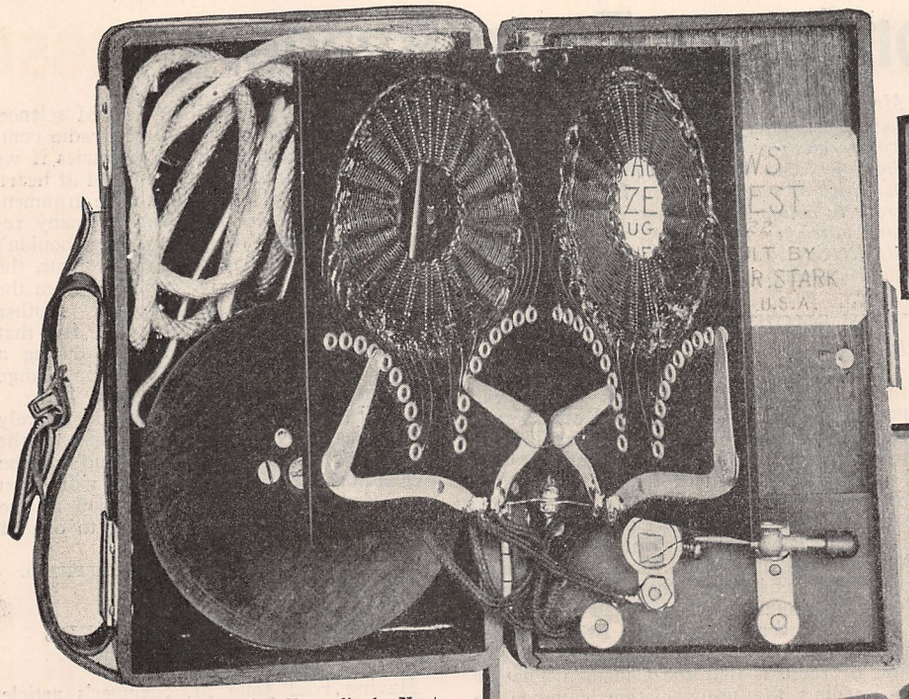
J. B. ARMSTRONG
Stop 16, Troy Road,
Schenectady, New York

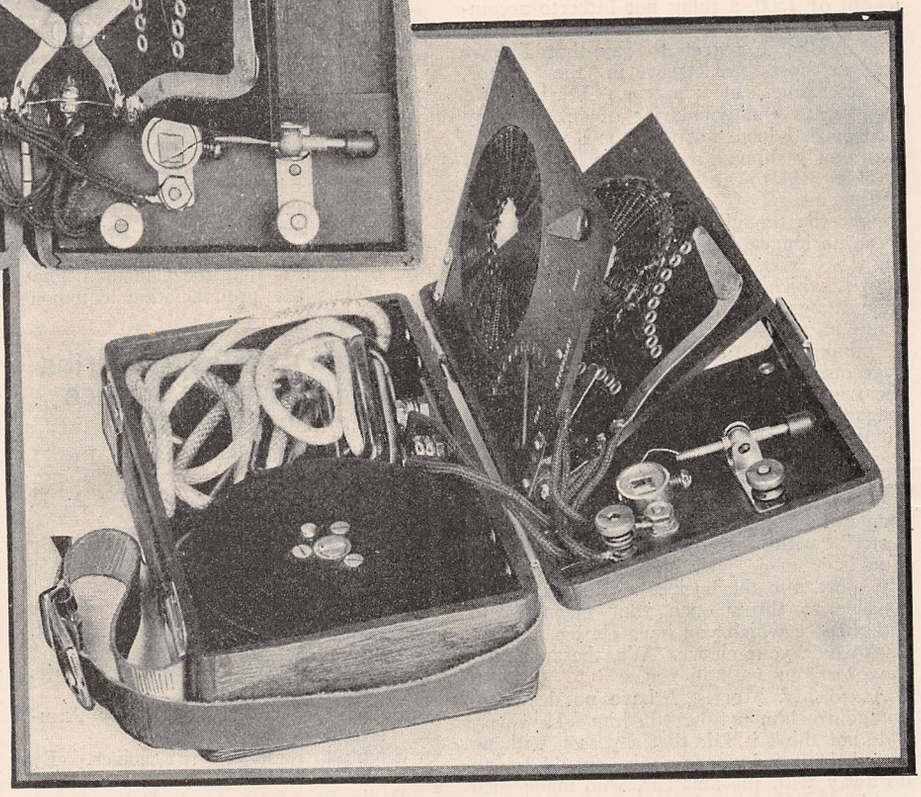
Third Prize $75

S. K. C. MOJEIKO
5510 Brosser Avenue
Cleveland, Ohio

Fourth Prize $50

B. HODGSON
191 Reservoir Avenue
Revere, Mass.





These Views Plainly Show the Exceedingly Neat Workmanship and Practical Design of This Prize-Winning Pocket Receiver. Note the Unique Method of Moving the Switch Levers. The Designers Are Shown in the Top Photographs.

insulator has a hook to attach to the antenna and a short length of heavy cord to attach to the limb or other stationary object. The anchor insulator has a clamp to attach to the antenna, the clamp being so placed that the antenna may be anchored at the proper point and the "lead in" carried down to the set.

It was found in practice that a phone stopping condenser of the smallest capacity would detract from the strength of the signals and so it has been omitted. The phone cord has sufficient capacity to pass the radio frequency and to furnish the necessary capacity in the crystal circuit.

This set, when in use with a 60′ to 70′ antenna raised about 40′ from the ground, will give good results on phone, 25 miles from Milwaukee, where stations WAAK and WCAY are located. The signals, although faint, are distinct and the set may be considered as successful at that distance and with stations of the power represented by these two.

Owing to the very short time allowance (we have only known of the contest since August 1), we have not been able to give the set a good work-out at shorter distances.

Second Prize

Pocket Radio Again

By J. B. ARMSTRONG

REFERRING to the first prize article of the "Pocket Radio" contest in the December, 1920, RADIO NEWS, the writer decided that a much smaller set could be built that would be equally efficient. Accordingly, the set described herewith was designed and built in about two weeks' time.

(*Continued on page* 795)

The Second Prize-Winning Model is Very Compact and Shows Excellent Workmanship. It is Enlosed in a Watch Case. The Watch Shown is on the Same Scale.

Correspondence From Readers

HUMOR GONE WRONG

Editor, RADIO NEWS:

I have just finished reading a certain article in your *Correspondence from Readers*, namely, that of Henry Morris. This article has given me certain mingled feelings toward you, RADIO NEWS and the writer mentioned above.

First, I experience extreme pity for H. Morris in his sad plight, for a fellow whose set finds a 3500 meter wave perched down on 210 meters. I also would compliment him on his extraordinary feat of having heard a signal of 200 meters on a wave length of 1500, a thing not hitherto accomplished.

Secondly, I regret to say that I have forever lost my trust in the Editor, as an American amateur. For several months, as the popularity of broadcasting developed, I have felt that the RADIO NEWS was slowly slipping away from the standard it once held toward the protection and encouragement of the amateur. I have fought the thought, but I realize now that I can no longer sensibly refrain from thinking so. You, by the publication of this article, which you know to contain impossible things, to show piteous ignorance of radio theory, code, or in fact anything pertaining to the amateur or radio in itself have openly deserted the amateur, cast away the friendship of those who supported your magazine, and respected you from the beginning, and thrown open your magazine to those who have destroyed, or are doing their best to destroy the *art* of radio, and commercialized our sport. You can no longer face the amateur and the "broadcaster" with an open, free conscience. You have made your choice and have left the sport, for the business. You would be sensible to throw open your magazine to the purpose which you have chosen and not try to hide your choice. We, the amateurs, have lost our trust in you.

As to Mr. Morris, I have no desire to antagonize him nor belittle him. However, I do not think it fair that a person with no knowledge of amateur radio, should try to do away with the amateur, who made such a thing as broadcasting possible, when the amateur should be the one protected.

Mr. Morris, Radio is our sport. If you played golf, and one day you went to the links and were told that all the links were reserved from 6 o'clock in the morning until 10.30 at night for professional players, "who played for the benefit of onlookers who didn't know anything about the game," but that you could play during the remaining time if you wished, how would you feel? You cannot read code, I am positive. Therefore you do not know that commercial stations only operate on 600 meters. You do not know that it is impossible to make an amateur transmitter operate, or even be heard on 600 meters, let alone 1500. However, if what you say is true, procure the call letters of the offenders send them to me, and I will obtain satisfaction for you.

I invite any cool-headed discussion of the subject and will answer any letter received. I would like especially to hear from Mr. Morris.

G. HAVELY HUMES.
1408 Cuyler Ave., Chicago, Ill.

(Poor Mr. Humes! Our heart goes out to him and we feel genuinely sorry for him. When we published Mr. Morris's letter in the August issue we took it for granted that all of our readers had sufficient humor to see the obvious exaggeration of the letter, making it a really humorous epistle, with some grains of truth contained therein. In that same letter Mr. Morris says, ". . . Some ham thinks he has to call a station 4,000 miles away," etc. Probably Mr. Humes took this statement seriously, too. Fortunately, this is the only letter that was received from our readers, so probably the other 234,999 read the letter in the spirit in which it was written. We presume, in order to oblige Mr. Humes, it will be necessary hereafter to label every article "HUMOROUS" or "SERIOUS," as the case may be.—EDITOR.)

WHY SHOULDN'T WE BE ALIKE?

Editor, RADIO NEWS:

I am writing this letter as an answer to that of Mr. W. E. Weaver which was published in the July issue of RADIO NEWS. In this letter Mr. Weaver expressed himself to the effect that young Canadians were becoming Americanized by reason of their listening to the programs of the broadcasting stations located in the United States. I sincerely hope that I can convince Mr. Weaver and any other Canadian amateurs who think as he does that there are absolutely no grounds for their distress.

Mr. Weaver brings out two principal points in favor of his contentions. The first of these is that the Canadian amateur is learning the pronunciation common to this side of the International Boundary. This is probably true, but it would only apply to a very few words and if Mr. Weaver will consult an authority he will find that either pronunciation is correct in these cases. I have spent considerable time in both Ontario and Quebec and never found any great difference in the use of English by the people who use it correctly. I know absolutely that there is less difference between the English used in Canada and the United States than there is in the English used in the different sections of this country. I think that Mr. Weaver will find this to be equally true as between the provinces of his own country. I am sure that every Canadian will agree with me when I say that a more general use of English in the Province of Quebec would be beneficial to Canada at large. Is there any greater incentive for the young men of that Province to learn English than that supplied by the broadcasting stations, whether located in Canada or in the United States?

The second point brought out by Mr. Weaver is that the Canadian amateur is learning the geography of the United States by reason of the interest created by his listening to the radio stations located in this country. I hope that Mr. Weaver is correct on this point. If radio transmission is helping to teach the young men more about the world in which we live it certainly has a far-reaching educational value aside from what it teaches in the field of science. On this point we must all favor radio communication between the two countries if we have the best interests of mankind at heart.

Mr. Weaver also puts forth the argument that Canadians are becoming in many respects like Americans. Well, why shouldn't we be alike? We have the same tongue, the same customs and derive our laws from the same source. England is our Mother Country just as it is yours and the fact that we could not tolerate conditions during a certain period in history can never change the source from which we owe our being.

In closing I wish to say that I sincerely hope that radio communication between the two countries is on the increase and that the time is not far distant when we will listen to a Canadian broadcasting station at the same time that you are listening to one of ours.

HALL E. SHEPHERD.
Nashville, Tenn.

Radio Articles Appearing in September Science and Invention

The Slot Machine Radio. By H. Gernsback.
Who Discovered Radio? By A. P. Peck.
Radio Outfit in Pickle Bottle. By Edgar I. Eisenstadt.
Tikker Reception of C.W.
Chopping Bowl Loud-Talker.
Radio Concerts from a Lamp Socket. By A. P. Peck.
Five-Stage Amplifier on 110 Volts A.C.
Radio for the Beginner. By Armstrong Perry.
Simplest Radiophone Receiver. By Frank Copeman.
Radio Broadcast, Up-to-Date.
Photos of Broadcasting Stations.
Radio Oracle.

MORE GALENA RECORDS

Editor, RADIO NEWS:

Having read John M. Shanner's article in the July issue of the RADIO NEWS, telling of his Galena records, I have decided to send you my record.

Using a home-made loose-coupler, with the primary winding of No. 20 S.C.C. wire on a tube 5" long, and 2¾" in diameter, and with the secondary No. 32 S.C.C. wire on a tube 4½" long and 1½" in diameter, each coil was taped at every 10 turns. I can hear when the QRN is not bad, WWJ 700 miles, WDAF 160 miles, DD5 500 miles, WCM 500 miles, WHA 500 miles, 5ZA 550 miles, WAH 350 miles, 9VT, 9DUN, 9DHB, WFAY. All of these are phones. I can clearly hear the key hit on 9DUN's C. W., 30 miles distant.

I can hear all kinds of sparks, of which these are the loudest, 9ND, 5XU, 5ZA, 5ZL, 5LO, 9AFX, 9AEG, 9BZZ, 9BMW.

I was using a pair of Type "E" Baldwin phones, and no condensers. My antenna is a three wire L type 45' high and 75' long. For a while I used a single wire 120' long and 30' high. For a ground I used a water pipe.

A concert from WAH at El Dorado, Kansas, was heard from 9 o'clock until 11 one night, the cat-whisker being held in place by a drop of tallow.

Let's hear of some more crystal records.

F. P. WATTS.
Independence, Kan.

ANOTHER GOOD ONE

Editor, RADIO NEWS:

Having read John M. Shanner's article in the July issue of RADIO NEWS concerning his galena record, I am sending you mine.

I have heard WGY, WDM, KDKA, WWJ, WJK, and 8XJ, and small stations nearby which number about five or six. All of these stations were heard on a piece of galena and a single slide tuning coil. KDKA and 8XJ came in very loudly, but the others were faint.

JOHN E. VALLOWE.
Homestead, Pa.

HIS CRYSTAL IS GOOD, TOO

Editor, RADIO NEWS:

Having read John M. Shanner's letter, published in RADIO NEWS for July, reporting his Galena record and asking to hear from some more galena records would say that on the nights of Jan. 5 and 9 I picked up music from KDKA at least five hundred miles distant, and on the nights of March 24, 28, 31, April 19, and 20, heard speech and music from WWJ at Detroit,

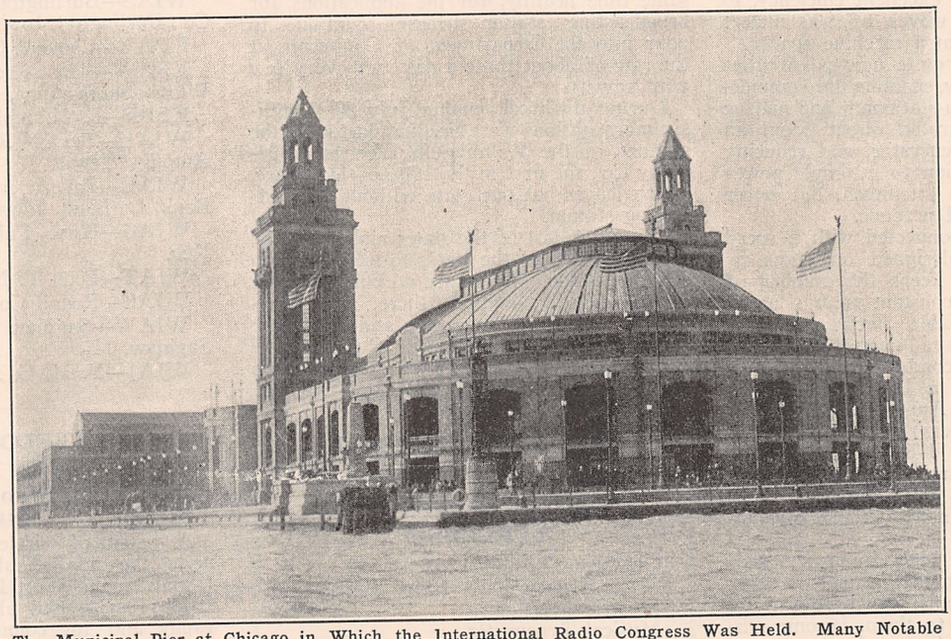
(*Continued on page 674*)

International Radio Congress at Chicago

By ROSCOE SMITH

THE International Radio Congress convened August 7th in Congress Hall, on the Municipal Pier which extends far out into Lake Michigan at the foot of Grand Avenue. Two celebrated figures in the electrical world, Guglielmo Marconi and Charles P. Steinmetz, gave their views as to the future of radio, one in a message sent to the Congress, the other by personally addressing the radio scientists gathered for the notable Congress.

Maj. J. O. Mauborgne, U. S. A., signal officer for the Sixth Army Corps area, and associate of Maj. Gen. George O. Squier in the Army's radio activity, was President of the Congress, and Commissioner George E. Carlson of gas and electricity of the City of Chicago, and sponsor for Chicago's Municipal broadcasting station, was chairman of the arrangement committee. Both are sanguine that the Congress will develop into a permanent organization.



The Municipal Pier at Chicago in Which the International Radio Congress Was Held. Many Notable Speakers Addressed the Congress.

A number of new inventions and improvements on radio made by the United States Army, by the U. S. Bureau of Standards, and by the engineers of the leading radio and electrical industries were announced for the first time at the Congress.

G. H. Clark, representing the Radio Corporation of America, read a paper submitted to the Congress by Signor Marconi, the keynote of which was the inventor's belief that a great future lay in store for the short wave radio.

"Recently the long wave has been in use because it generally has been more uniform at the receiving station, but now with the directive energy on the short wave, it will be much more satisfactory, as it is essentially more punctual," Signor Marconi said. "I have found that the absorption, or fading away is less when a directive transmitter is used, and I have been able to cover 100 miles with short waves."

Radio Day at the Pageant of Progress, so called because it was the opening day of the International Radio Congress held in conjunction with Chicago's Pageant of Progress, got well under way by the direction of Major Mauborgne, signal officer of the Sixth Army Corps, who officiated as President of the Congress. While the Congress was in session the balance of the Pageant was listening through huge amplifiers distributed over the pier, and the middle west was also in attendance through "KYW," broadcasting station.

Visions of a powerful sheet of electric power traveling over the earth, to be used in a selective manner by all receiving stations for every purpose for which electricity is used today, were depicted in an illuminating address by Charles P. Steinmetz, consulting engineer of the General Electric Co., who spoke on the subject, "Radio."

"The successful development of radio communication by telegraph and telephone," Dr. Steinmetz said, "raises the question of the possibility or impossibility of radio power transmission. In some respects, radio power transmission exists today, for the message which you receive by radio has been carried by the power of the electro-magnetic wave from the sending to the receiving station. However, while the sending station sends out electro-magnetic waves of power of several kilowatts or even hundreds of kilowatts, this power scatters in all directions, and it may be only a fraction of a milliwatt which we receive, that is, less than a millionth of the power sent out.

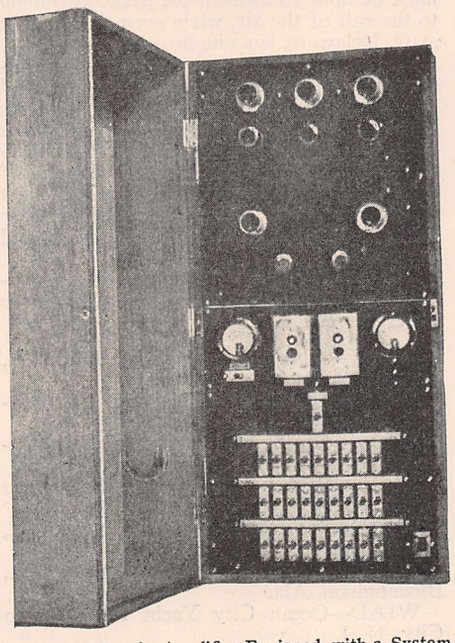
(*Continued on page* 732)

The Use of Power Tubes in Radio Reception

By HERBERT E. METCALF*

THE sustained interest in radio broadcasting by the general public of this and other countries has led to a greater interest in the proper type of receiving set to use in connection with the reproduction of the wireless music and speech in the home. Not only in the home, but in many other places such as halls, auditoriums, stores, etc., radio has come to be more or less indispensable. Inasmuch as the modern receiving set costs more and more, according to the amount of volume of sound required, it is of interest to all to get the maximum volume for the minimum investment, and it is in this respect that power tubes become useful in radio reception.

A man may go to a radio store and buy a crystal receiving set with phones for perhaps $25. This may keep him interested for a little while, particularly if he is close to a broadcasting station, but eventually, he will wish to get the music and speech a little louder. This means a vacuum tube receiving set with its accompanying storage battery, "B" battery and panel. Even then, the music will not usually be loud enough for a loud speaker, and he then adds a two-stage amplifier in hopes that he may be able to hear the music as well as he might hear music from a phonograph. Quite often he is disappointed and feels that a larger and more expensive set must be used to get greater volume, whereas, really, by means of a proper tube selection, he may get a much greater volume from this set than he is at present receiving. When this man went to a radio store, as likely as not he knew nothing about tubes or if he did he probably thought they were all alike; consequently, the radio dealer included with the set he bought, what he, the dealer, thought was the proper tube selection. In 99 per cent of the cases the radio dealer gave him a soft gaseous content detector tube and two more or less soft amplifier tubes. On operating his set with these tubes he was immediately aware of several things: First, his detector tube was extremely sensitive in its "B" battery and filament adjustments; second, he found that he could not increase the volume of his set by increasing the "B" battery voltage of his amplifier tubes over 90 volts. If he did, his tubes choked, did not amplify, and in case he bought a three-stage amplifier, he found that the third stage did not amplify loud signals.



A Type of Power Amplifier Equipped with a System of Switches Permitting the Operator to Connect Several Loud Speakers Located at Different Places.

There is, however, one other tube which the average radio enthusiast of today has more or less ignored, and that is the power or transmitting tube. And why should he not have ignored it, because he had been taught that a detector tube was for detecting, an amplifying tube was for amplifying, and a transmitting tube was for transmit-

(*Continued on page* 785)

**Radio Engineer, The Magnavox Company.*

Radio Digest

AN ALTERNATOR TO TRANSMIT 900 METER WAVES

By Our Berlin Correspondent

A new advance has been made in the field of radio engineering. In fact, Mr. Karl Schmidt, chief engineer of the Messrs. C. Lorenz, of Berlin-Tempelhof, has succeeded in raising the frequency of the current derived from an ordinary 6,000-cycle alternating current dynamo, with normal number of turns and excellent efficiency, to 360,000 cycles, i.e., waves of 900 meters are thus emitted from a machine sender.

This will open up quite new possibilities to wireless telegraphy, enabling the commercial waves, as usual in stationary and marine practice, to be generated direct from an alternating current generator, and reducing the radio sender station to a simple power plant, a result often attempted, but never yet obtained in actual practice.

The generator is connected with a speed controller, likewise designed on plans by Mr. Schmidt, which keeps the number of revolutions at such constant figures as to exclude any appreciable fluctuation even with the short waves corresponding to 360,000 cycles per second. According to a notice received from a Dutch government department, which in Amsterdam (at a distance of 600 kilometers) received the signals from a normal 1-KW ship installation, these signals arrived with perfectly constant wave-length, pure pitch and considerable acoustic intensity without any amplifier.

It is thought that high frequency generators will thus, even in the field of short waves and small outputs, which so far did not seem to be open to them, become efficient competitors to the system at present used.

RADIO DEVELOPMENT ABROAD

UNCERTAINTY AS TO BRITISH BROADCASTING PLANS. RADIO COMMUNICATION BETWEEN DENMARK AND SWEDEN

There is still much uncertainty regarding the conditions under which wireless broadcasting will be carried out in England, according to the Electrical Division of the Department of Commerce.

Differences have arisen between manufacturers and the Postmaster General, and conferences are now being held, attended by representatives of between 40 and 50 firms, including those which have applied for licenses to broadcast. The vital question is as to the erection of broadcasting stations, one group wishing to have the construction of all of them handled by one organization, and the other, composed of smaller manufacturers, opposing this office which they characterize as monopolistic.

The scheme as outlined calls for eight stations which are expected to cost approximately £20,000 each. In connection with the cost of the broadcasting program it has been suggested that the Government's "Listening in" license fee be increased and that the additional sum thereby obtained be placed in a common fund out of which the program would be provided. At present it is proposed to charge 10/6 ($2.44 at par) for registration of receiving sets.

RADIO TELEPHONE BETWEEN DENMARK AND SWEDEN

Reuter's Trade Service states that the radio telephone circuit between Copenhagen and Bornholm was recently opened to the public. The arc system is used for transmission and the rates charged are lower than for similar service by telegraph. This is the first public radio telephone circuit to be placed in service in Scandinavia.

451 BROADCASTERS OPERATE IN ALL STATES EXCEPT WYOMING

When KDKA, the first broadcasting call, was assigned nine months ago to the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., even the Chief Radio Inspector did not suspect that today there would be 451 stations broadcasting, one or more in every state except Wyoming. The growth has been phenomenal, but at the same time healthy, for the applications for broadcasting station licenses continue to pour into the Department of Commerce at the rate of about three a day, with very few withdrawals.

During the week ending July 29 twenty-six more stations were licensed, including the stations of the Wilmington Electrical Specialty Co., the first in the state of Delaware, which leaves but one state without a broadcasting station.

Wyoming, last of the states alphabetically, is also the last of the states to take up radio communication. There are no public service or broadcasting stations there, no experimental or technical operators and only three special or advanced amateur stations; one each at Douglass, Casper and Elk. In the whole of the Seventh Radio District, comprising Wyoming, Oregon, Washington, Idaho, Montana, Alaska, there are only about 750 amateurs transmitting, while in other districts the number runs into two or three thousand. Evidently something must be done to awaken the great Wyoming to the call of the air, when even the smallest state, Delaware, has one broadcaster.

Some of the Interesting Articles Appearing in Practical Electrics for September

Old Time Trolley Experiences.
Great Electric Advertising Signs.
Electric Fountains.
Musical Typewriter.
High Frequency Current Experiments. By Leonard R. Crow.
Spectacular Illumination for the Brazilian Exposition.
Home Medical Coil and Violet Ray Set. By A. J. Christopher.
Home Made X-ray Screens. By Raymond B. Wailes.

Naturally the greatest number of broadcasting stations are operated by electrical manufacturers and dealers, but one of the keenest interests displayed is that of the press of America: sixty-eight newspapers are broadcasting today for the benefit of their readers and the public in general. Last week five joined the throng, one each in Pennsylvania, Indiana, Iowa, Nebraska and Wisconsin.

The twenty-six broadcasting stations licensed by the Department of Commerce were the following:

WIAN—Chronicle & News Pub. Co., Allentown, Pa.
WIAQ—Chronicle Publishing Co., Marion, Ind.
WIAF—Gustav A. DeCortin, New Orleans, La.
KFBE—Reuben H. Horn, San Luis Obispo, Calif.
WJAD—Jackson's Radio Eng. Lab., Waco, Texas.
WIAG—Matthews Elect. Supply Co., Birmingham, Ala.
WIAD—Ocean City Yacht Club, Ocean City, N. J.
WHAW—Pierce Elect. Co., Tampa, Fla.
WIAP—J. A. Rudy & Sons, Paducah, Ky.
WIAC—School of Eng. of Milwaukee, Milwaukee, Wis.
WIAL—Standard Radio Service Co., Norwood, Ohio.
WHAV—Wilmington Elec. & Specialty Co., Wilmington, Del.
WIAE—Mrs. Robert E. Zimmerman, Venton, Iowa.
WJAB—American Radio Co., Lincoln, Neb.
WIAS—Burlington Hawkeye-Home Elec. Co., Burlington, Iowa.
KPAV—Cooke & Chapman, Venice, Calif.
KFAW—The Radio Den, Ashford & White, Santa Anna, Calif.
KFBF—F. H. Smith, Butte, Mont.
WJAE—Texas Radio Syndicate, San Antonio, Texas.
WIAU—American Security & Savings Bank, Le Mars, Iowa.
WJAG—Huse Publishing Co., Norfolk, Neb.
WIAT—Leon T. Noel, Tarkio, Mo.
WJAC—Rodoll Co., Joplin, Mo.
WIAW—Saginaw Radio & Elec. Co., Saginaw, Mich.
WJAJ—Y. M. C. A., Dayton, Ohio.

RADIO DEVELOPMENT IN FOREIGN LANDS

WIRELESS TELEPHONY FOR THE WEST INDIES

A system of wireless telephony now connects the Turks Islands and the Caicos Islands in the West Indies, the same installations being used also for wireless telegraphy and for communication with ships. The distance covered by the radio-telephone circuit is about 12 miles.

Recent advices received at the Department of Commerce from Trade Commissioner Young, Riga, state that during May a new wireless telephone broadcasting station, located on the Kursk Railway station in Moscow, was opened by the People's Commissariat of Post and Telegraphs. The station was built by the Nizhni-Novgorod laboratory of the Government, and is designed to broadcast messages and wireless press sent out by the Government.

WIRELESS SERVICE FROM ENGLAND TO SPAIN

The wireless traffic between England and Spain, which has been handled for some time by land wires to the Poldhu station and thence by radio, has been greatly improved by the substitution of the new Marconi station at Ongar as the transmitting agency. This station is worked by distant control from London, so that messages filed in that city are sent direct by radio without any retransmission. The same station is now working on schedule with three other continental wireless stations, according to the Daily Mail.

Poldhu, located in Cornwall, is one of the oldest and probably the best known of the European high-power radio stations. At the present time it is not being actively used and its eventual disposition is uncertain, although there has been some discussion of a plan to convert it into a radio telephone broadcasting station.

WIRELESS SERVICE FROM EGYPT

The Egyptian Department of State Railways, Telegraph and Telephones has announced through the press that commercial wireless service is open to the public from the station at Abou Zabal, according to a report received at the Department of Commerce from Consul Maynard, Alexandria. Since 1914, when the station was completed, it has been used only for Government messages, but will now handle commercial

(Continued on page 748)

The True Story of the de Forest Vacuum Tube

By CHARLES GILBERT*

MUCH is being written to-day about marvels of the Audion lamp, the tiny glass bottle which has revolutionized the world of communication. The lamp itself is frequently described as a development of the two-element tube, a perfected valve, an improved incandescent light, or a rectifier to which has been added de Forest's now famous little grid. It might be of interest, therefore, since public recognition has been given radio, if we record at this time the true story of the invention of the de Forest vacuum tube.

It was in the summer of 1900 that de Forest was experimenting in his $2 a week room in Chicago when he chanced to come upon the discovery of what he, at first, thought was only a strange phenomenon. On this memorable night, he was working on an electrolytic detector. His wireless apparatus was placed on a table beneath a Welsbach gas burner. The spark coil he was using as a source of oscillations was located in a closet about ten feet distant.

On one occasion, when he closed the switch of the spark coil by means of a string running across the floor from his table, he observed there was a decided change in the illumination from the Welsbach burner. As soon as the sparkling ceased, the light from the gas mantle increased very perceptibly, resuming its normal brilliance. This phenomenon continued and impressed itself strongly upon the attention of the youthful investigator.

Further experiments with the gas mantle soon convinced de Forest that "heated gas molecules were sensitive to high frequency electrical operations," but it was not until three years later that he returned to the development of his gas mantle idea.

Dr. de Forest did considerable work, then, with various types of Bunsen burner arrangements, and set up a laboratory type of flame detector which was actually used in 1903 for receiving signals from ships in the harbor of New York. The inconvenience of supplying a source of gas for the new detectors was of course obvious, and de Forest sought for other means of obtaining the necessary heated gas and heated electrodes. The next experimental step was an electrical arc, but an arc was found to be very irregular and noisy in the telephone receiver.

After the arc came the idea of an incandescent filament in an enclosed chamber. And, thereupon, de Forest put his "Jinn in the Radio Bottle." Thus it will be seen that de Forest developed his audion from an entirely different angle from that commonly supposed to-day, not from the incandescent light, the rectifier or the two-element valve, but directly from the heated gases which he himself introduced into the lamp.

**President and General Manager, de Forest Radio Telephone & Telegraph Co.*

While Experimenting With a New Detector in 1900, Dr. de Forest Discovered That the Light of a Gas Burner Was Affected by the Discharges Produced by a Spark Coil.

There is no mistaking the fact, either, that even at the time when the first audion patents were issued, June 26, 1906, de Forest realized the true importance of his discovery. He then said:

"The audion, the most sensitive and closely tuned receiver in the world today, I consider to be my greatest achievement."

The audion used an absolutely novel principle, that of the sensitive hot gas as distinguished from the cruder, solid and liquid, receivers employed by others.

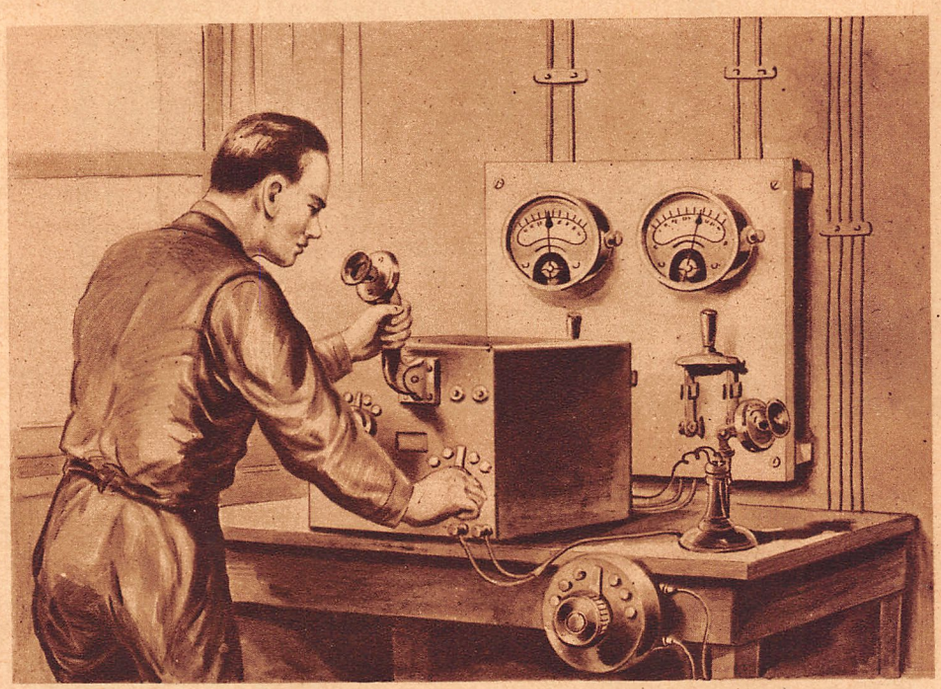
Almost immediately following the granting of the first audion patents as a wireless receiver, came the discovery by de Forest that his audion bulb could be used as a telephone relay. Some kind of a telephone relay had been long sought in vain by the leading telephone engineers of the country. It was not until several years later, however, that de Forest was invited to demonstrate his audion relay to the engineers of the American Telephone & Telegraph Company.

Considerable discussion has arisen as to the first use of the audion as an oscillator, or source of alternating current. It was in the summer of 1912, when at work in his Palo Alto Laboratory in California, that de Forest discovered that his audion could be made to oscillate or to generate sustained alternating currents of any frequency, still the same audion upon which is based the modern evolution of the radio art.

Another activity of the audion on the development of which de Forest has been working for many years was the production of synthetic music. Demonstrations of the musical audion were made publicly before the New York Electrical Society in December, 1915, and proved of great interest to musical as well as scientific circles.

It was the hope of the inventor, at that time, to perfect his audion musical apparatus, but still another more inviting phase of audion activity led him in the direction of what may now be regarded as another notable achievement with his audion lamp, namely, the invention of the talking motion picture film, or as he himself describes it, the phonofilm. As in the case of our present

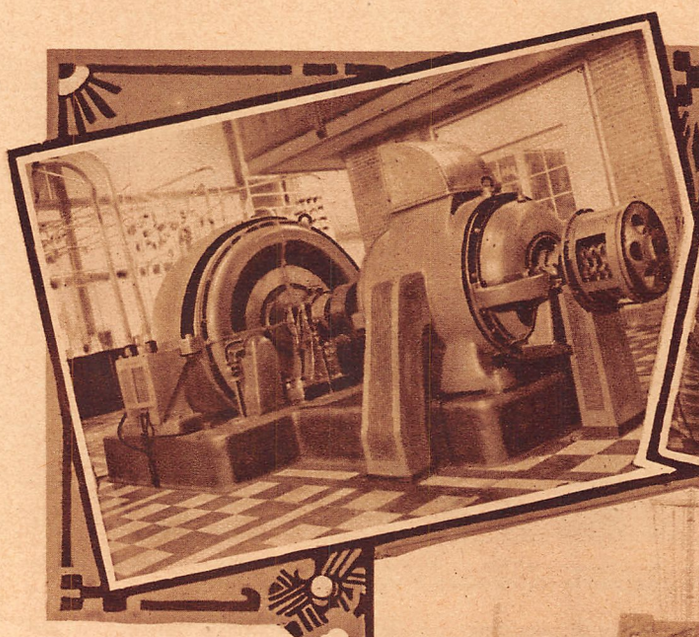
(*Continued on page 692*)

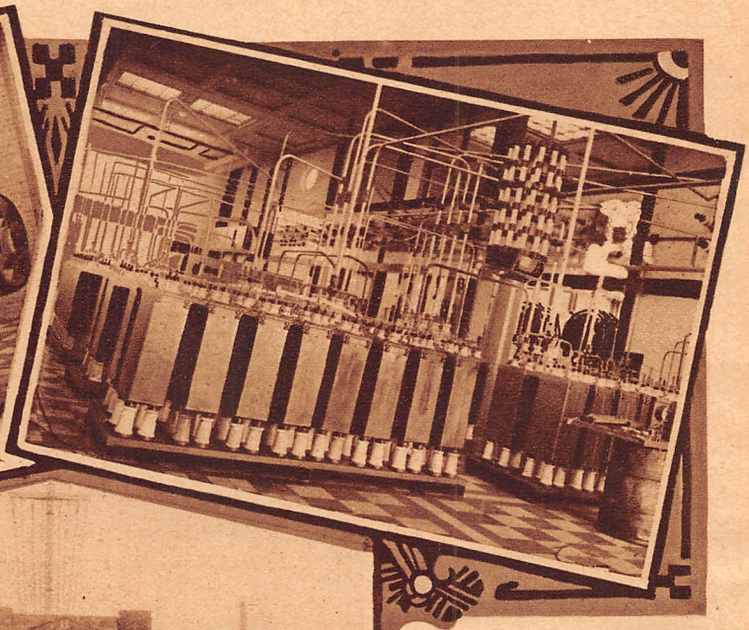


In His Early Radiophone Experiments de Forest Used an Arc Transmitter Which Was Soon Replaced by Vacuum Tubes. He Installed a Radiophone Station on the New York Opera House in 1908 to Broadcast the Performances.

New Developments in German Radio

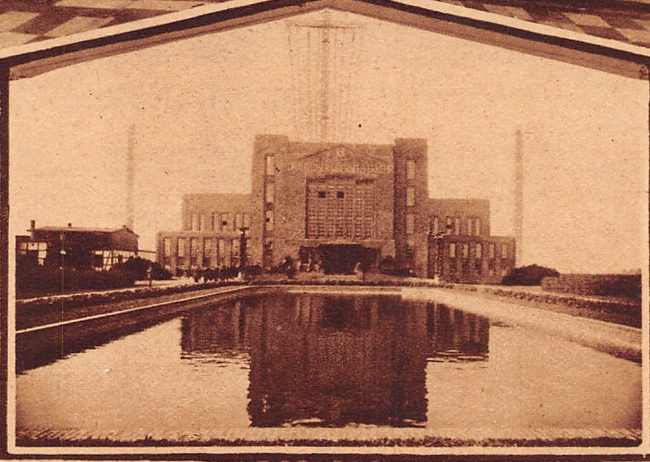
By DR. ALFRED GRADENWITZ
Berlin Correspondent of Radio News





Above—High Frequency Alternators at the Nauen Station.

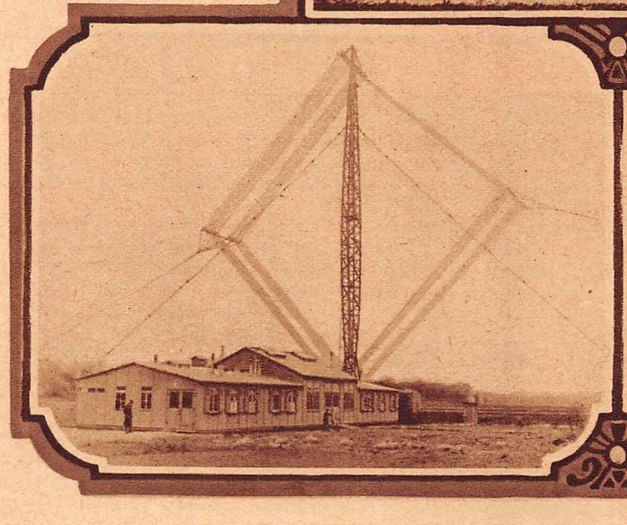
Below—Enormous Loop Used in Tests for Transmission and Reception at the German Transatlantic Station.

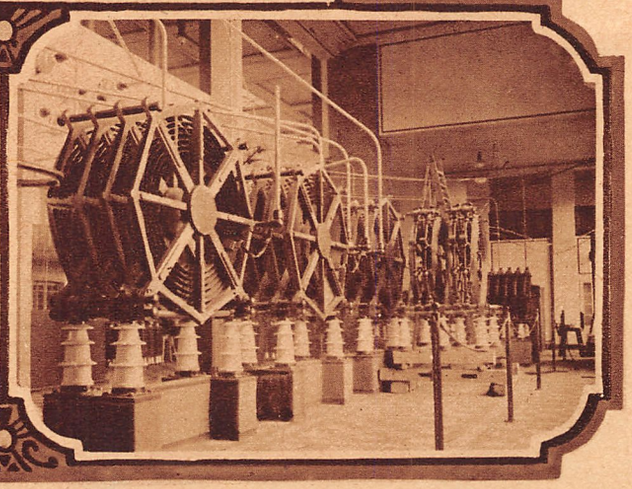


Above—A Section of the Transmitting Set at the Nauen Station with a View of the Condensers.

Left—General View of the Station.

Below—The Transmitting Inductances at the Nauen Station.



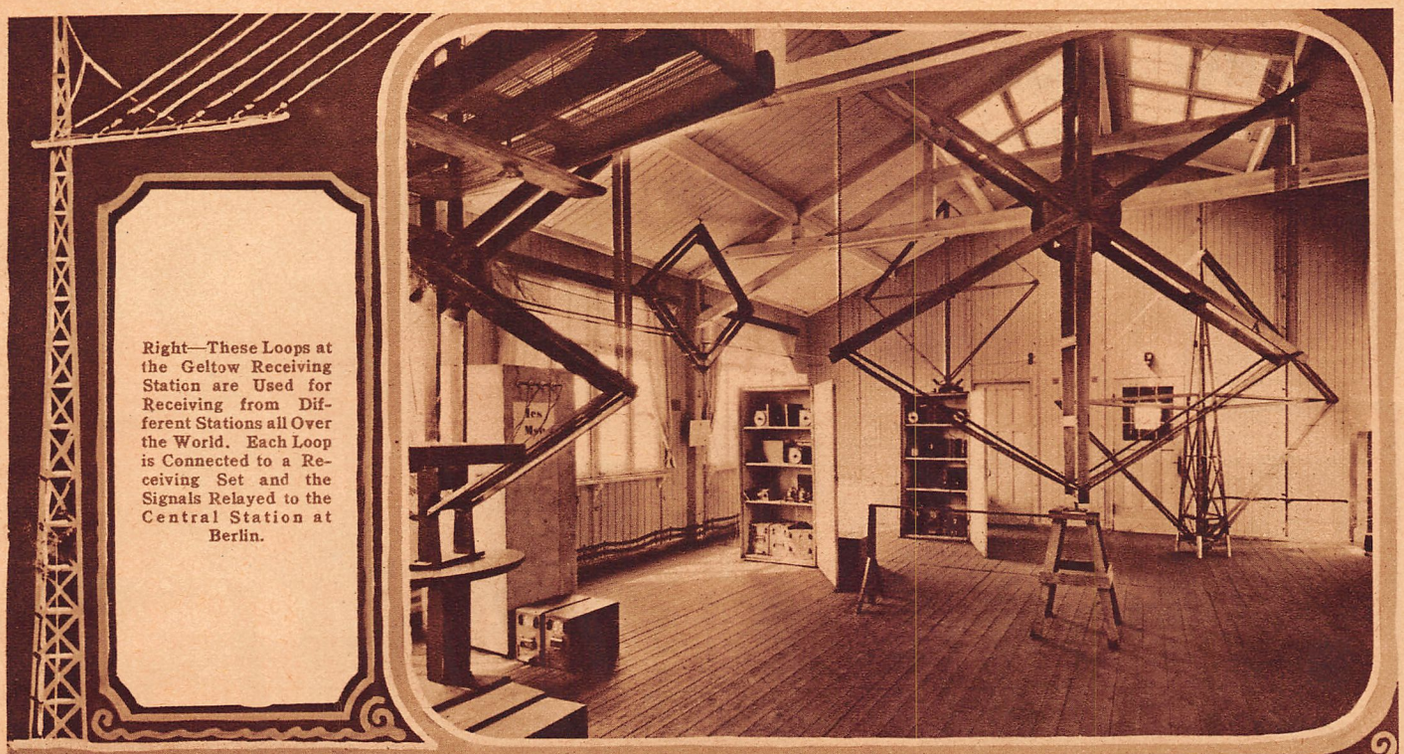


THE unprecedented strides made by American radio are, of course, watched with great interest in Germany where the drawbacks of the present State monopoly are keenly felt. Before long, it will doubtless be possible for the common run of mortals in Germany, as abroad, to own and operate private radio stations, though, under present economic conditions, progress in this respect will be slow. In the meantime, the interest of radio engineers centers around the public wireless telegraph service and the broadcasting of economic news to subscribers. The latter subject will be taken up in another article. In this present article I wish to discuss the recent improvements in the European and Transatlantic Wireless Telegraph Service.

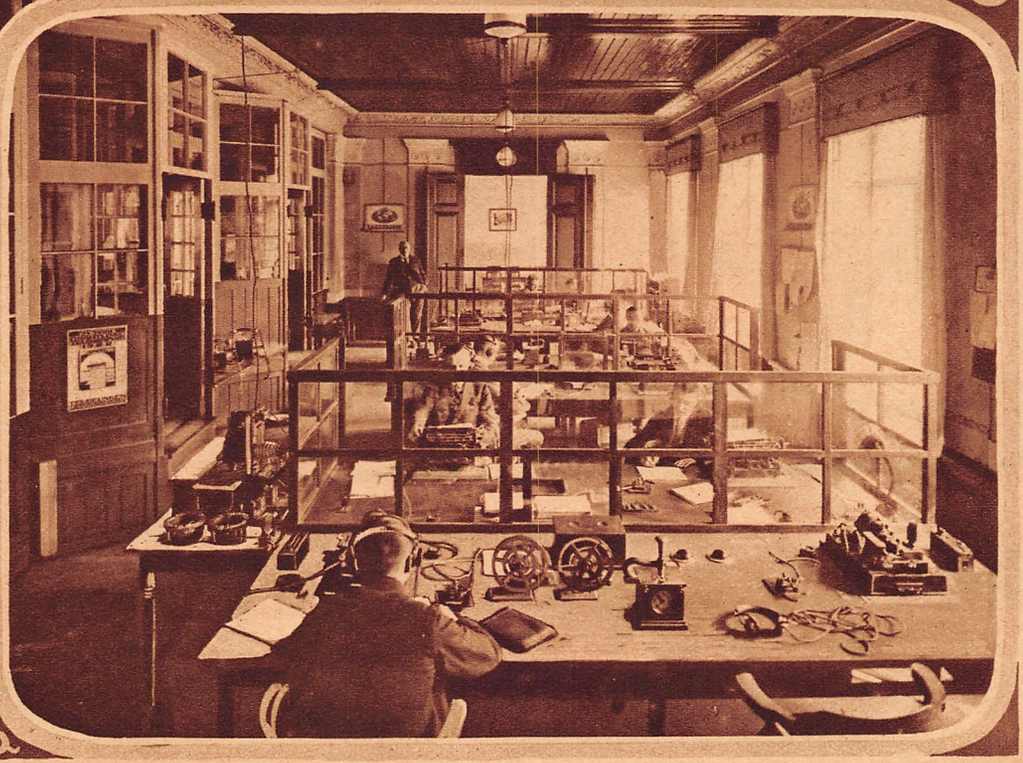
Being invited to the opening of the new Transradio Central Station, at the premises of the Oranienburgerstrasse Main Telegraph Office, the writer and a small circle of scientific journalists, Government officials and business men were entertained with a series of addresses on the various aspects of German radio-telegraphy. We found ourselves in a building where invisible threads communicating with all parts of the world are now combined and connected with the wired *and* wireless telegraph systems of Germany and the rest of Europe,—where the limitations of space and time are overcome on a grandiose scale.

Count Arco, director of the German Wireless Telegraph Company ("Telefunken" Company) first drew attention to the importance of recent technical improvements,

(*Continued on page* 684)



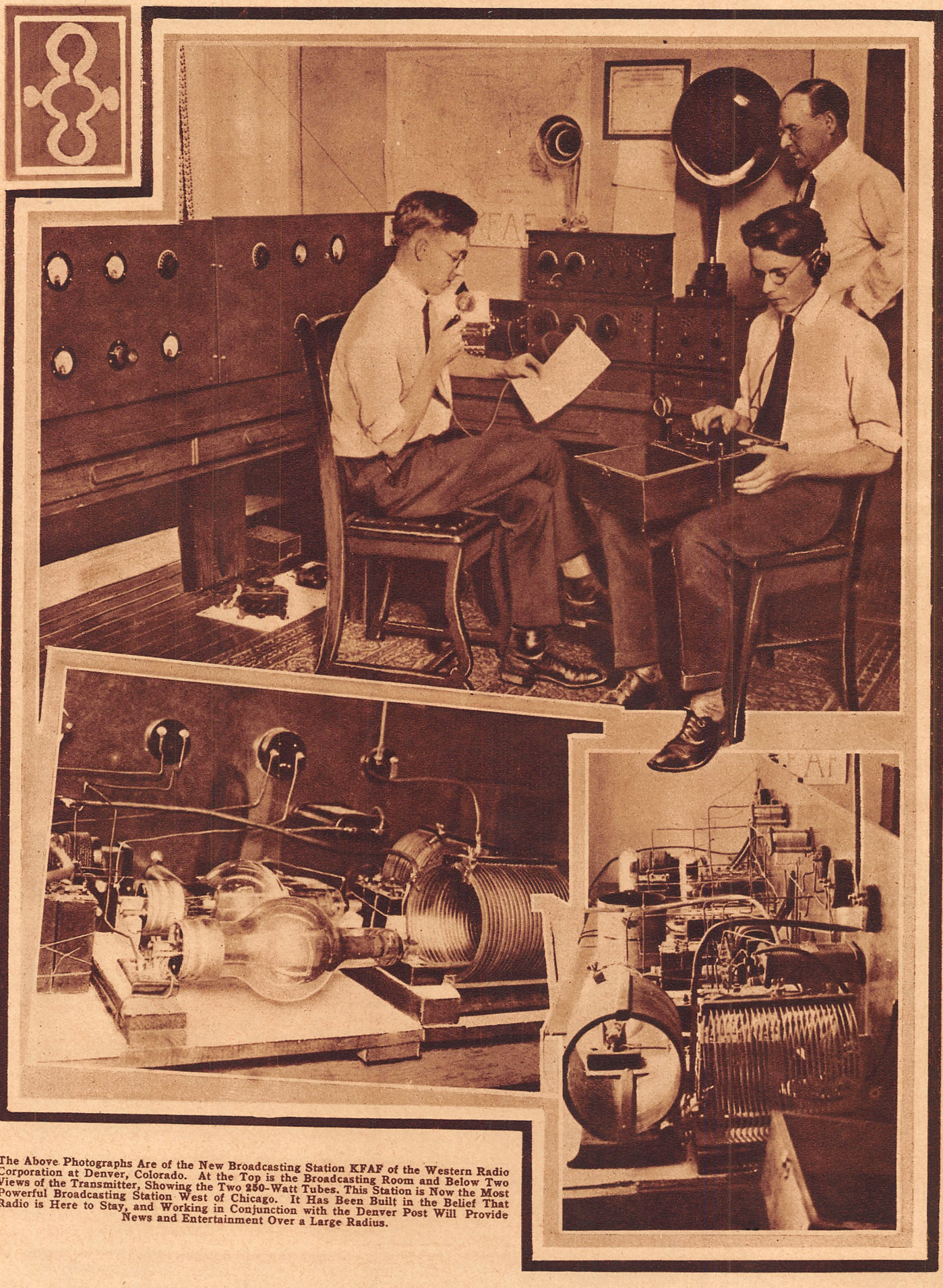
Right—These Loops at the Geltow Receiving Station are Used for Receiving from Different Stations all Over the World. Each Loop is Connected to a Receiving Set and the Signals Relayed to the Central Station at Berlin.



Above—Punching the Tape for Automatic Transmission from Radio Central Station at Berlin. The Nauen Station is Operated by Remote Control.

Right—These Operators at the Berlin Central Station Control the Transmission of One Station and Receive from Another Station. Transmitting and Receiving Operators are Seated Side by Side. Duplex Operation is Conducted.

New Broadcasting Station at Denver

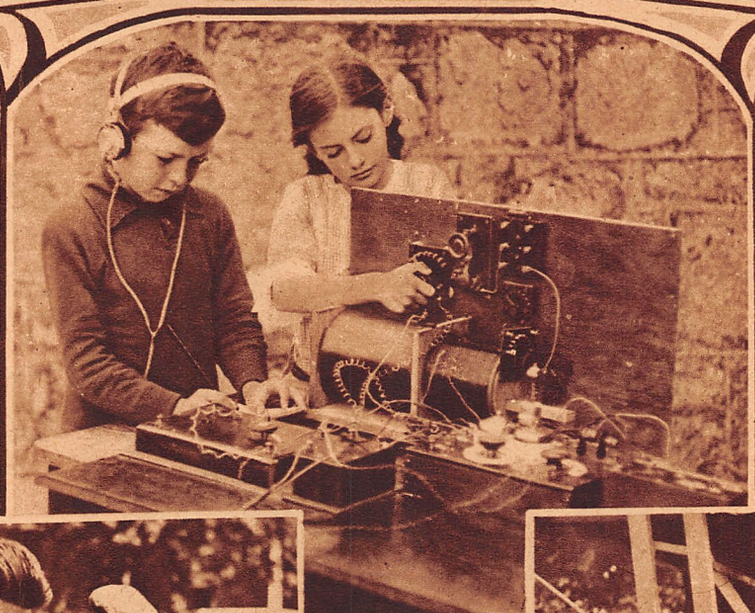


The Above Photographs Are of the New Broadcasting Station KFAF of the Western Radio Corporation at Denver, Colorado. At the Top is the Broadcasting Room and Below Two Views of the Transmitter, Showing the Two 250-Watt Tubes. This Station is Now the Most Powerful Broadcasting Station West of Chicago. It Has Been Built in the Belief That Radio is Here to Stay, and Working in Conjunction with the Denver Post Will Provide News and Entertainment Over a Large Radius.

With the Radio Kids

Above: This Receiving Set Was Built and Designed by These Kiddies. They Are Enthusiastic Over Radio and Are Budding Amateurs. They Use the Clothes-Line Antenna.

Photo © K & H



Right: Two Pupils of an English School Practicing Code on the Receiver Which They Constructed. This is One of the First Receivers to be Installed in an English Elementary School.

Photo © P & A

Above: These Boys Set Out to Fool the Landlord and Succeeded. They Disguised Their Antenna to Look Like a Clothes-Line by Running Copper Wire Through the Center. It Acts Just as Well as the Ordinary Aerial and Can Still be Used for the Clothes.

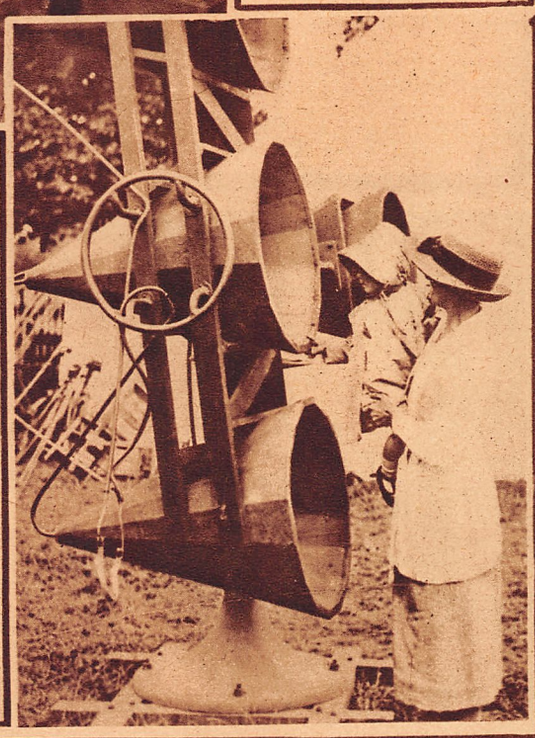
Photo © K & H

Right: The Old Aerial Listeners Used in England During the War for Detecting Air Raiders Are Now Being Employed as Radio Horns.

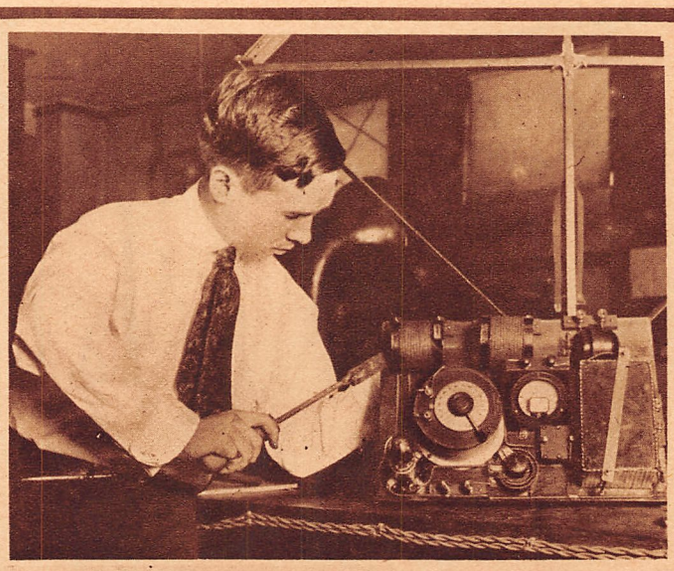
Photo © K & H

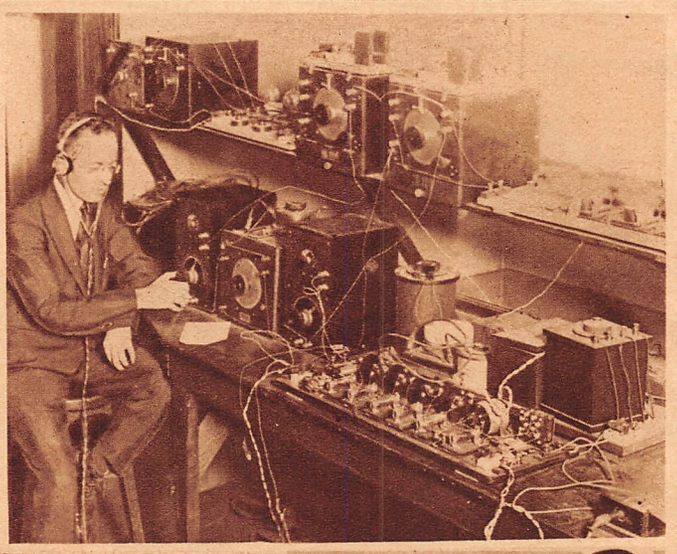
Left: This Lad Has Fitted His Bicycle With a Radio Set and Rides Around WashingtonListening in. He Carries the Flashlight Batteries in His Pocket.

Photo © U & U



Radio Developments at New York City College

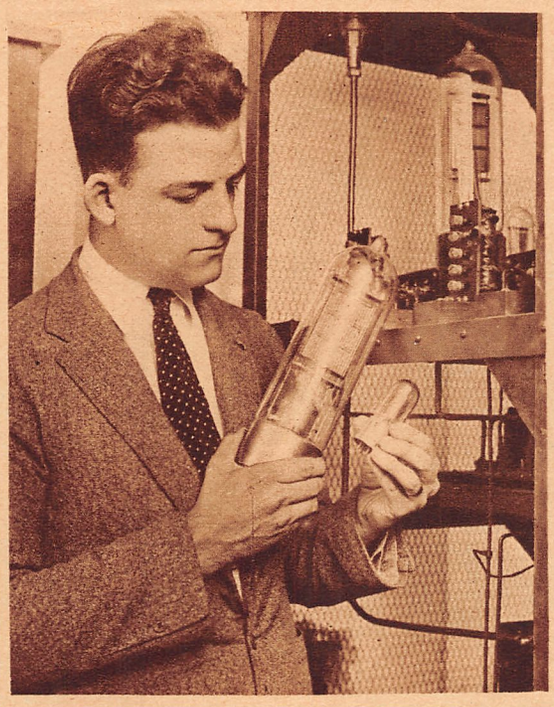




Above: A New Low Power Transmitter Which Operates on 50 Meters. Tests Will Probably be Made With Super-Regenerative Receivers Which Amplify Short Waves Enormously.

Below: Dr. Goldsmith of the City College With a New Compact Uni-Control Receiver. It Comprises a Complete Tuner, Detector and Two-Stage Amplifier With the Necessary Filament and Plate Batteries. Peanut Tubes Are Employed.

Photos © K & H

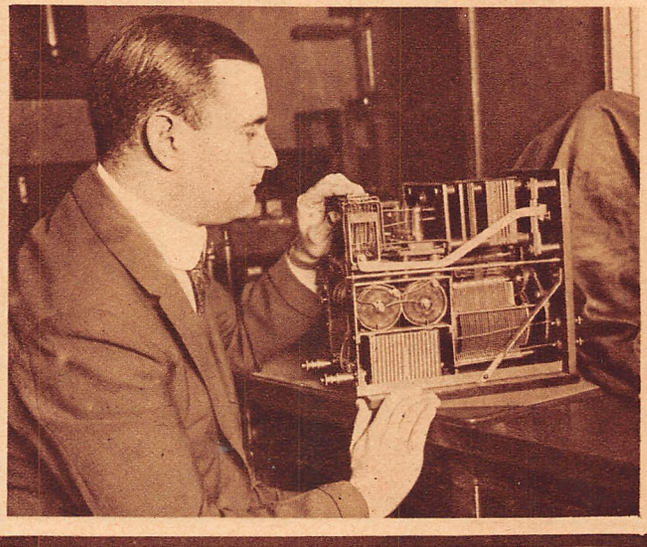


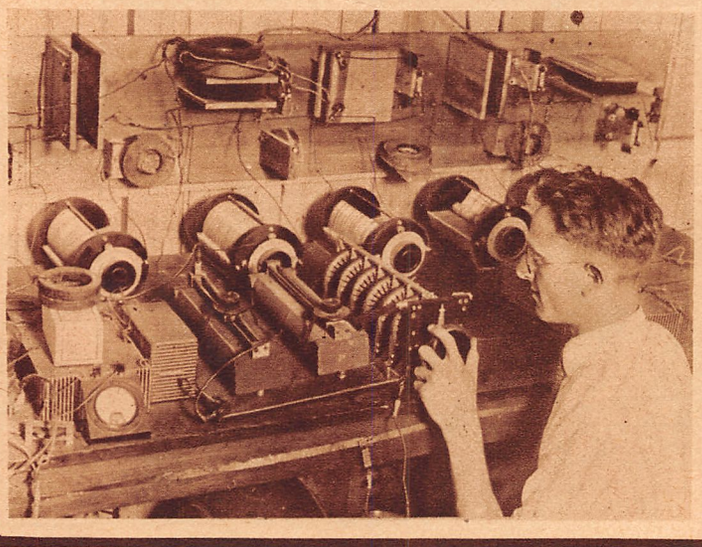
Above: Radio Set for Research Work on Long Distance Reception at the New York City College.

Left: The Large 250-Watt Transmitter tube of the Western Electric Company, Compared With a J Tube. Some Tube!

Below: A New Circuit Used in Receiving High Speed Transoceanic Radio Telegraph Messages. The Single Control Adjusts Six Different Circuits at the Same Time.

Photos © K & H





French Amateur Activities

The Pre-War and Post-War Stations of a French Amateur

By MARIUS THOUVAIS

(Editor's Note.)—These photographs of French amateurs' stations are indications of the progress that has been made since the severe restrictions on amateur transmission have been removed by the French Government. The interest in radio is rapidly growing in all parts of Europe and we trust that the action of the French authorities is a forerunner of better days for the European amateur. Although the number of stations in France is limited, they are well equipped with modern apparatus. We hope, in the near future, that it will be possible for exchange of traffic to be conducted between the French and American amateurs. The possibility is not remote as recent tests proved, and now that the restrictions on transmission in France are removed, we may expect early attempts to be made.

A Typical French Amateur Station with a Universal Wave-Length Receiver. This Picture was Taken Recently and Shows that Mr. Thouvais Keeps Well Posted Regarding the Progress of Radio, through the Numerous Radio Magazines.

IT may be interesting to compare side by side the two accompanying photographs: My earliest crystal set and my latest valve station. Many improvements have taken place since the galena days and there is a marked advance between the two sets. Look at the pictures: It is the same table, the same lead-in with its same aerial-earth switch, also the same operator—only some years older! But nearly all the apparatus that was in use in the first crystal set has become useless, except the phones and the condenser and plug board.

All the apparatus is home-made with the exception of two galena detectors, phones and audions, and although not quite of professional appearance, it has proved very efficient.

The aerial in use now is exactly the same as that used the first time; it is a three-wire type, 37 meters long, average height eight meters—with a seven-meter lead-in. Its fundamental wave-length is in the neighborhood of 230 meters. It is fastened at one end to the higher chimney of my house and the other end to a wooden mast in the garden, quite well insulated by a chain of porcelain pulleys. Its reception of spark stations with the original galena receiver has been excellent.

A glance at the first photograph will show that there were six galena detectors, any of which could be selected by the six-way switch standing in the middle of the panel; these detectors are each upon separate holders fixed to the wall, thus ensuring efficient protection against shocks. In fact any detector could keep its sensitive point over several months. Tuning is done by a two-slide coil (left hand), and a fixed loading coil (right hand, behind the operator's arm). Although it was an "oudin" hook-up, there were two variable condensers, one on the "primary" with a series parallel switch, and the other across the "secondary" side. These two condensers shunting across the same inductance, were not very useful, but they permitted an increase of the wave-length range and became much more useful when I progressed to valve reception.

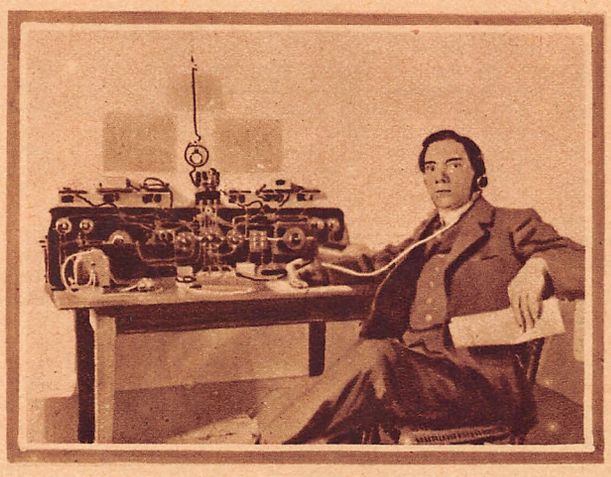
After the war, when I succeeded in obtaining a receiving license, I re-erected my aerial and for some time had to receive on galena again as audions were not, at that time, easily obtainable.

Here are some of the distant spark stations I was able to read regularly with the good old galena; MPD (Poldhu) and BYB (Cleethorpes), quite strong, BYO, BVY, GNI, BYY, BWW (Gibraltar), and BYZ (Rinella Bay, Malta). This last station, 1,000 miles away, has even been read through MPD and BYB jamming. Other stations such as IQZ, IDO, ICI, HB, OHD, POZ, KAV, OST, PCH, SAJ, SAB, EGC, EAA, etc., came in quite well as did also numerous ship and coast stations. I may state that even in February-March, 1920, the first Chelmsford telephony experiments were heard on single galena without any amplification, clearly enough, but not very strong.

About a month later I (at last!) got my first audions and immediately started building up a three-step high-frequency (resistance capacity) amplifier with reaction coil in the last plate circuit, coupled to the aerial tuning inductance for regeneration and the reception of continuous waves. I was surprised at the results obtained with this new piece of apparatus, leaving the crystal detectors a long way behind the times. Most high power European stations spark as well as C.W., could be heard all over the room and every station on the Continent could be well received, including the Russian ones, whose MSK and SEW sparks were quite loud on their true note. Annapolis NSS time signals were also clearly received daily. As I had no means of charging my accumulators at that time, I soon tried a single audion reaction set (an audion detector with a tickler coil), in view of saving filament current consumption. This single audion set gave me fairly good results, nicely readable signals from all European stations and from three American ones (NSS, WSO and WII). My tuner consisted of six fixed loading inductance coils (cylindrically wound), in addition to the old two-slider coil, but all these bulky coils were not yet sufficient and I had to add a fixed condenser across the variable ones to reach the longest waves, which somewhat lowered the efficiency.

The German telephony from Koenigwusterhausen (LP) was received with the phones on the table with the three-stage amplifier, while it was still nicely understandable with the single audion detector (with the phones "on" of course!) The Dutch concerts from The Hague (PCGG) were also received with but one bulb, but much more weakly as, unfortunately, at this relatively short wave-length, the resistance capacity amplifier did not work well.

Last year I decided to dismantle my already out-of-fashion amplifier and to build another amplifying board capable of working well on all wave-lengths, from the shortest up to the longest, and allowing one, two or three stages to be used at will. For the tuner of this new set I tried all the known methods of winding: single layer, pile-wound, honeycomb and duolateral coils, but I kept two types only: Basket coils for waves shorter than 2,500 to 3,000 meters and "slab pancake" inductances for the longer ones up to 24.000 meters. I now have a set of six basket coils and eight slab coils. Such a number is unnecessary, but is found useful, as it gives large "overlaps" allowing



The Simplified Station as It Was Before the War. At That Time Crystal Detectors Only Were Used.

a lower capacity to be used to tone in on the whole wave-length range, further increasing the efficiency.

Every coil has been calibrated against the well-known calibration waves sent out regularly by FL, YN, UA, LY, LO, GFA, QMT, etc. Each coil has its curve with condenser readings as regard wave-length and stations usually received.

In the larger photograph the new set may be seen standing in the middle of the table. It consists in the main of two similar wooden boxes, each holding an audion and a tuning stand (coil holder and the usual large and vernier condenser). The adjusting knobs of the condensers and rheostat stand on the front panel, near at hand.

This set is rather an uncommon one, as it is composed of two separate single audion sets; each one is in itself a complete receiver. I will not now venture into a detailed description of this special arrangement, as this would need much space, however, I hope to deal with it more fully at a later date. I shall only say that the first box acts as a usual single tube regenerative receiver, while the second set may be operated as *a further heterodyne*, interfering with the incoming waves which are rectified and amplified by the first box *working then just off the oscillating point*, thus providing an astoundingly loud and selective reception of long-wave stations. The second box may also be used as a detector and second-stage amplifier, with or without tickler coil, the first set acting then as a high frequency tuned amplifier, giving thus an excellent and extremely selective amplification on all wave-lengths.

I must say, however, that the two boxes working together, as the tuning is *exceedingly sharp*, the complete set is rather difficult to manage and will, in the hands of a beginner, give beautiful howlings!

The third tube, which may be seen in the photograph, on right-hand side, operates either as a short-wave receiver, when combined with the small loose coupler, or as an audio frequency amplifier when connected up to the output side of either boxes through the usual iron-core transformer.

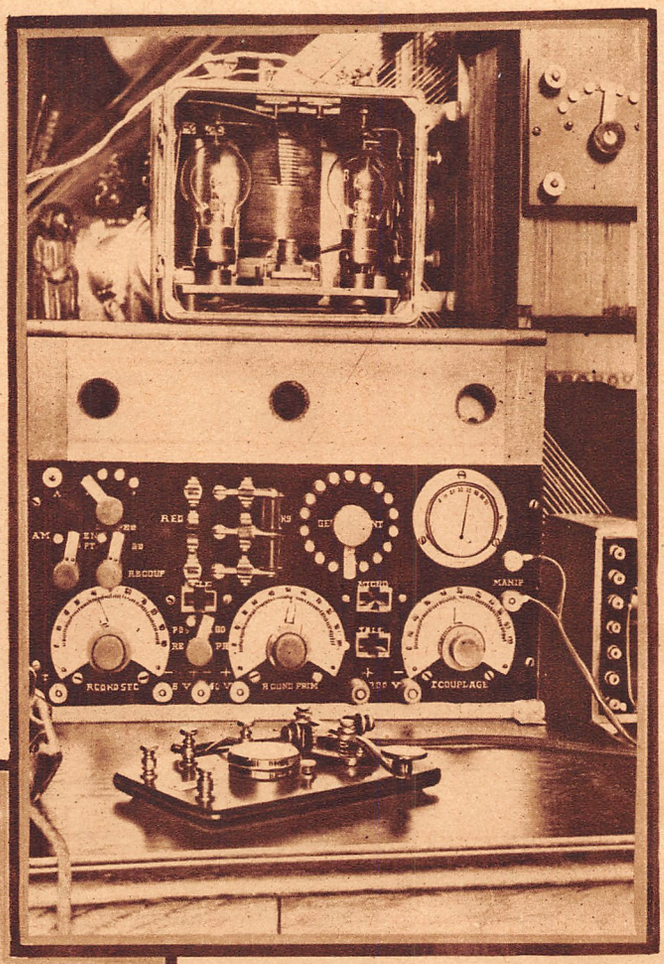
Some of the results obtained will doubtless interest readers; using one tube only, (the first box alone) such high power stations as FL, UA, YN, LY, YG, MUU, BYC, GBL, IDO, POZ, OVI, etc., can be read with the phones lying on the table, simply by putting a phonograph horn upon one of the earpieces. When QRN and QRM are not too bad, five American stations may easily be read: NSS, WGG, WSO, WII and WQK. Even on account of its longer wave-length the latter can be read at all times, being never too much jammed.

I find the best time to listen to the Transatlantic transmissions is in the morning, between 5 and 9 A. M. and better still on Sunday morning, when local and European stations seem to be quiet. As previously stated, these results are obtained with a single audion detector; when I use the first two tubes, such stations as POZ (over 600 miles away) can be read, all doors open, over 30' from the operating room, while American stations, when well tuned up, come in quite clearly, at all times, in spite of any jamming.

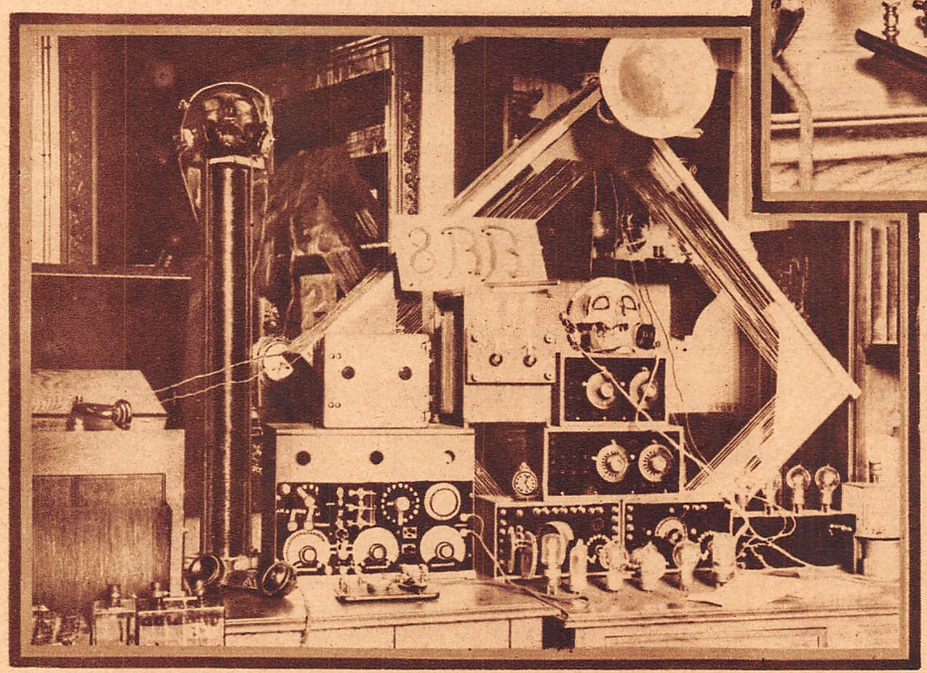
The audio-frequency amplifier is used for weak telephony only, for instance to magnify PCGG, the Dutch concerts, or QMT, the English broadcasting. Of course this is not necessary for FL broadcasting and St. Assise telephony and concerts.

A word may be said regarding the tubes used; the first I had were FOTOS; they were of the French Army type, and were the best I ever had, as they have been in continuous use for over two years and still remain quite good. Later I tried other French tubes (metal ones) which gave satisfactory results also; unfortunately I was unable to test any American tubes which are not on sale in this country. I am now trying the new low-consumption bulb. (French W type). This new kind of tube takes about a third of the filament current usually required, which is from 0.15 to 0.2 amp. under four volts only. They give

(*Continued on page 692*)



Below is a View of a French Amateur Station Equipped with a Radiophone and C.W. Transmitter; It is On of the First Amateur Transmitting Stations of that Country. On the Table are a Short and Long Wave Set with Radio and Audio-Frequency Amplifiers. On the Right is a Close-up of the Transmitters. The C.W. Set is Above and Consists of Two Tubes in Parallel as Oscillators. The Radiophone Below is a Combination Transmitter and Receiver Such as Used by the Signal Corps of the French Army.



French Amateur Station, 8BB, at Paris

THE accompanying photograph is of the apparatus used at 8BB, owned by James Bachollet, 61 Avenue de la Republique, Paris 11, France, and operated by Paul L. Barralon.

On the left is the first radiophone transmitter. This set uses three 10-watt tubes and the second (portable set) uses two 10-watt tubes, one as oscillator and one as modulator. This small set gives wonderful results and we have improved its range from 49 miles last month to 60 miles this month. Our present radiophone transmitter is equipped with French sending tubes and a dynamo furnishing 12 and 800 volts for the filament and plates. Best results have been obtained with Western Electric V.T. 2 tubes.

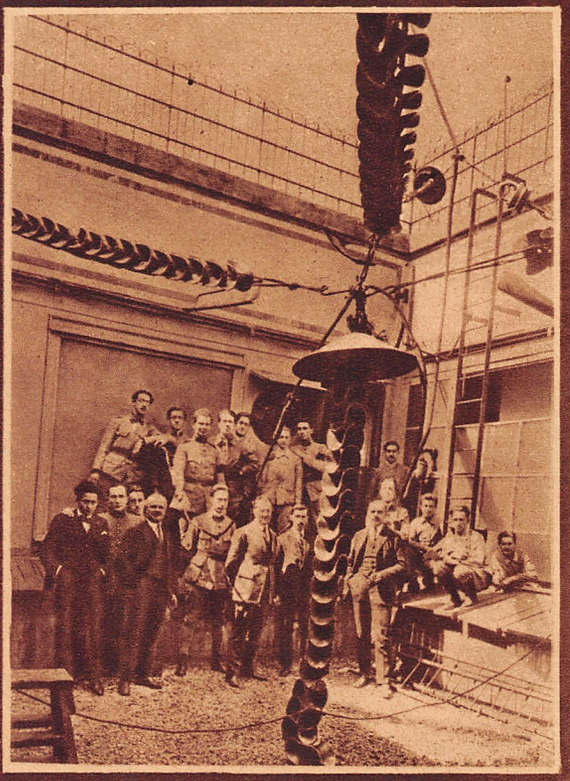
On the right are the receiving sets, one for short waves, from 180 to 800 meters, and one for long waves, from 800 to 29,000 meters. The second apparatus is regenerative, four radio frequency tubes and two radio frequency tubes. We are using Baldwin, Brown and Sullivan phones.

Reception is accomplished at any time of the day or night, without trouble, with the large loop aerial. We receive all the big stations of Europe and America, Annapolis, Rocky Point, Tuckerton, Marion, which come in loudly enough to be heard all over the large room when the aerial is used with the loud talker. The antenna is an L inverted type, four wires 100' long and 4' apart, at a height of 60'.

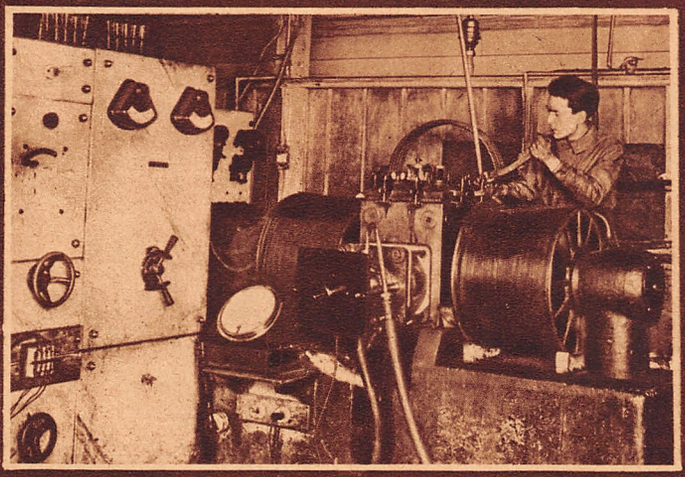
Those who gave us the first information and data for the construction of a set were American soldiers in 1918. We became acquainted with some of the boys and now we have several friends in the good old United States

Eiffel Tower Station at Paris

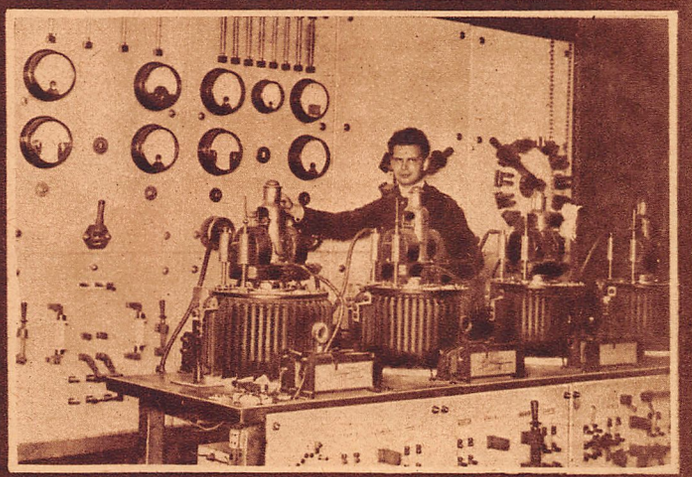
Above—View of the Eiffel Tower, at the Base of Which is the Radio Station. The Antenna is Suspended from the Top of the Famous 1,000-Foot Tower.



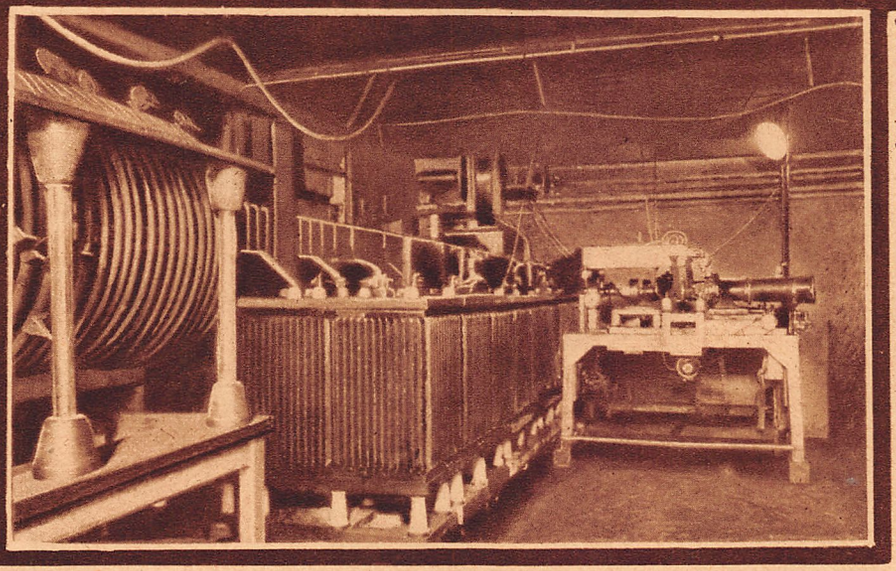
Above—The Station Personnel Are Grouped Near the Huge Lead-in Wire and Insulators.



Above—The Poulsen Arc Used at "L for Undamped Wave Transmission.

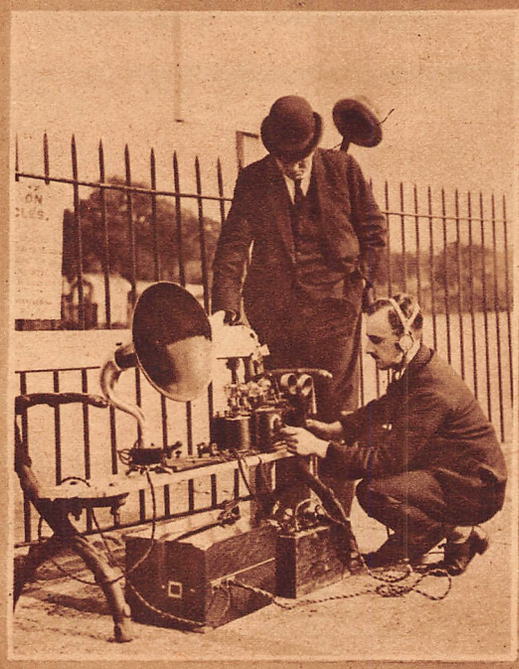


Above—The Mercury Turbines for Manipulating the Arc. Behind is the Control Switchboard of the Arc Transmitter.

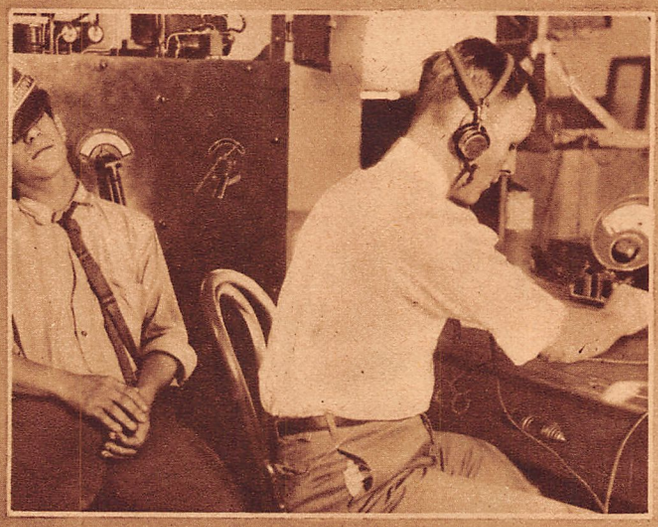


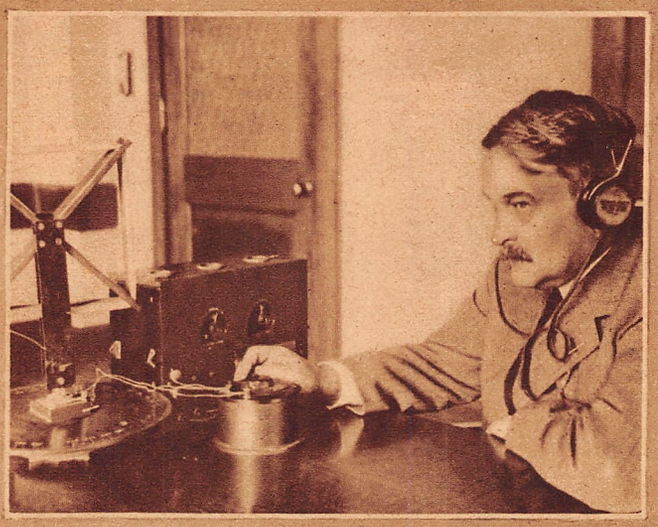
Left—The High Tension Room of the Old Spark Transmitter. In the Foreground is the Inductance Installed When FL was First Opened.

Wanda Hawley, Well-Known Star of the Movies, Invites You to Listen In on Her New Receiving Set.

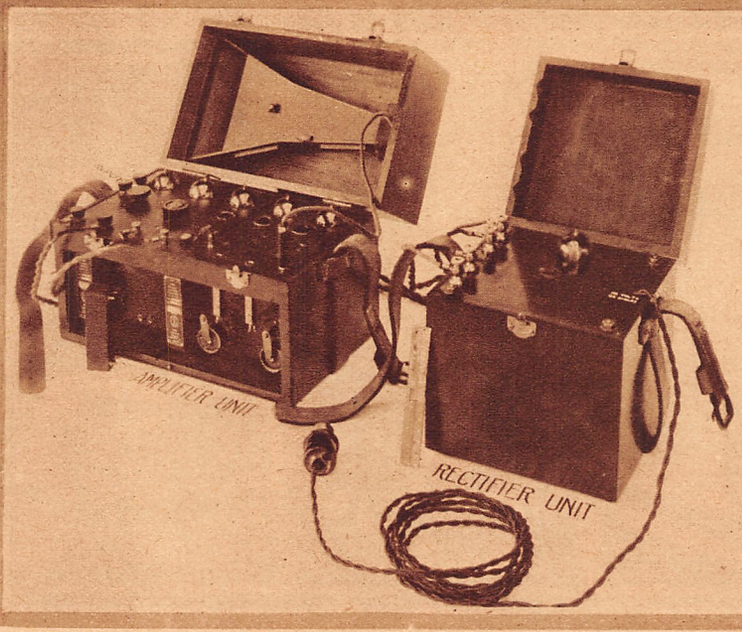


Interesting Tests Were Recently Made at Brooklands, England, to Keep in Touch by Radio with an Automobile Racer Attempting to Break the Endurance Test by Traveling for 12 Hours.





The Government, Through Its Radio Service in the Post Office Department, is Using Radio Instead of Telegrams Wherever Possible. The Telegraph Messenger Boy Will Soon Be Out of a Job if the Progress of Radio in the Post Office Department Continues.



Above: Dr. S. W. Straton, Director of the Bureau of Standards, Receiving on a 9-Inch Loop Antenna.
Left: This Complete Rectifier and Amplifier Has Just Been Developed by the Bureau of Standards and Permits Reception Without Any Plate or Filament Batteries, the Necessary Power Being Obtained from the A. C. Light Lines. The Circuit Used in This Apparatus Was Given in the September Issue of RADIO NEWS.

One Way or Another

A Play in One Act

By ERALD A. SCHIVO

While the Captain's Back Is Turned, Sears, Throwing in the Switch for Sending, Speaks Into the Transmitter: "Boys, Police Have Secret Code. Make Your Getaway the Best Way You Can and Disregard All Instructions From This Station."

CHARACTERS:

POLICE CAPTAIN MATHEW BRADY
JOHN SEARS
TWO DETECTIVES

The scene is the wireless station at police headquarters. Necessary radio apparatus for receiving and transmitting is located in the rear of the room on a table. A half-dozen red books, each about the size of a pocket dictionary, are on the receiving cabinet, which is to the left of the radio telephone. A door on the left side of the room leads to another room which is for the convenience of the police wireless operators. A door to the right leads to the corridor and elevators. Near the door is line telephone attached to wall, and above the door is a clock on wall indicating 9 o'clock, running throughout scene. Simultaneous with the lifting curtain, the door on left side of room opens and Police Captain Mathew Brady enters. He walks to the wireless apparatus and seats himself in a comfortable chair. He then puts on the head set and throws aerial switch to receiving position.

There enters through corridor door John Sears.

Mathew Brady is a successful police captain in the early forties, while John Sears is a criminal, suspected by the police of many crimes for which the evidence is lacking. He is about 30 years of age.

Captain (*surprised*)—I thought, Sears, that you were to "pull off" a highway robbery to-night?

Sears (*nonchalantly seating himself in a chair near the wireless apparatus*)—What makes you think so, Captain?

Captain—Didn't you send this?

(*He takes a sheet of paper from the table and places it in Sears' hand.*)

Sear (*reads*)—Captain, you think you can get us fellows by such a foolish thing as radio, but I'll prove that the wireless will never get us. Here's your chance. Watch for an auto robbery tonight at 9:15. (*He hands the sheet to the Captain.*) Do you think I would admit sending that note?

Captain (*replacing sheet on table*)—You never know what a crook may do.

Sears (*angrily*)—Don't call me a crook, Brady, I have never been convicted of any crime yet.

Captain (*grimly*)—Nevertheless, you were implicated in many, but we lack the evidence. Sometime, somewhere, I will get you, and I will have the evidence!

Sears (*smiling*)—Come, come, Captain, let's be friends tonight. I have come to watch you operate the radio set. It will please me to see how you fail to capture the auto bandits. (*He laughs.*)

Captain (*with determination*)—While I operate this radio set no highwayman will get out of this city in an automobile, not if the robbery is reported in time.

Sears (*laughing*)—And how will you prevent them, may I ask?

Captain (*thoughtfully*)—Well, I might indiscreetly tell you now, but I think not, although all the radio magazines will soon be explaining the different methods; however, I don't mind giving you a case we had the very first day we used the apparatus. A couple of burglars robbed a house on Frederick Street and made their getaway in an automobile. A pedestrian saw the burglar come through a window and then get into a waiting machine in which another man was seated. The couple headed for the ocean beach. The witness phoned me and gave me a description of the machine and also the license number. After getting the important information I immediately threw my aerial switch to the transmitting side. (*He thrusts aerial switch to sending position.*) It is very simple, I turn this handle and this rheostat— (*He adjusts radio telephone transmitter.*) The set is now ready for sending. All I did was to call certain police automobiles near the beach. I then gave them all the information necessary. The burglars were arrested on Lincoln Way. (*He throws switch into receiving position and turns off transmitting current.*)

Sears (*sarcastically*)—Suppose, Captain, that the bandits' machine also has a wireless receiver and intercepts your orders. It is not very likely that they will continue to head toward the beach. You have a lot to learn yet, Captain. Didn't think of that, did you?

(*Continued on page 692*)

The Newspaper Radio Editor

By S. P. WRIGHT

THE little boy who used to be called "queer" because of his mania for radio, is now the most admired and respected young man in his community. Radio is quite the thing now; static is torturing the tympanic membrane of some of Society's (with the well-known capital S) biggest bugs, and the modulated continuous wave is rapidly becoming more popular than the Marcel wave. The dim lights of audions are proving a greater lure than the bright electrics of the White Way. All of which is merely an introduction.

When radio sky-rocketed from obscurity to its present prominent place, every newspaper in the country with a circulation of over 347 started a radio page. Papers under this circulation merely had a radio column or two. It is these outbursts in the daily sheets that are the cause of *this*—which, by the way, is another black mark against them. Judging from results, it must have happened something like this:

The Article on the Radio Page About Detectors is Really Good. "The Property of Unilateral Conductivity," We Are Informed, "is Peculiar to Certain Ores. If it Were Not for This Property Radio Communication Would be Impossible, as We Would Hear Both Sides of the Cycle at Once." Simple, Isn't it?

When the time was ripe, the editor of the paper decided that there must be a radio department, a "Question and Answer" column, "How to Make It" article,—in fact, the whole works. A little investigation proved that the cub reporter who was covering the police court had a cousin who once operated a galena detector set belonging to a friend. This expert was, therefore, given the title of "Radio Editor," a book on "Elementary Radio" published in 1912, and a three-dollar-a-week raise; that made fifteen.

His first article was something of a masterpiece—perhaps you read it. "The aerial," he stated, "should be composed of strands of wire not more than 200 meters in length, and should be insulated on both ends to prevent the capacity from exceeding the resonance." So far, so good, but he gets tangled up a bit on grounds—something on this order:

"The set should be grounded when not in use," one learns, "to separate a ground. When in use, another ground is used, as a much heavier ground is needed for lightning protection than for operating the set. . . . The ground switch should have an amperage of at least 500 volts, in order to conform with the Undertaker's Rules." The electrical industry has long maintained that the Underwriters Laboratory was composed of a bunch of dead ones, but—well, let's go on.

His article on detectors is really good. "The property of unilateral conductivity" (fine words, those, to roll under your tongue, eh? Like "Logarithmic decrement" and "Internal impedence"), we are informed, "is peculiar to certain metallic ores such as silicon, galena and perikon. If it were not for this property, radio communication would be impossible, as we would hear both sides of the cycle at once." Simple, isn't it?

Audion tube theory has balled up many a good man, but not our doughty Radio Ed. Far be it from such—listen:

"The theory of the action of the audion can be briefly explained by saying that it acts like a valve. The filament is constantly throwing off large numbers of minute particles called electrons which strike the plate with considerable force. When a signal comes in, it acts in such a way as to increase the speed of these particles, thus making them strike the plate a harder blow. This produces the sound in the receivers." And to think that it took DeForest so long to work out such a simple thing as that!

After all, it is in the "Questions and Answers" column that he is at his best. "A. F. G." wants to know why his audion wouldn't work with a dry cell for a "B" battery—"this cell is much larger than the 'B' batteries in the store," he claims, with some degree of truth. Don't think that this query stumps Ye, Ed. Far from it:

"ANSWER: The wave-length impressed upon the plate circuit by a dry cell is not sufficient to cause the tube to oscillate. Naturally, then, it would not operate at its maximum characteristic." Which we contend is the truth, too!

Little "M. M. L." is "a high school girl reader" of his "very interesting column, and would like to ask a question to settle an argument." It appeared that she could have asked a cousin of hers by the name of Theodore (not named after the late Teddy, but in honor of an uncle on her mother's side,) but Theodore was in a town in Montana, she forgot the name, but it was somewhere in the northern or northeastern part. He was on his vacation, and was learning to ride horseback like a regular cowboy, or so he said, although she couldn't *imagine* his doing that, but Theodore was so far away and not very obliging anyway, and probably wouldn't know, at that, so she was, as has been said, asking the Radio Editor. Having thus come directly to the point, she inquires whether or not Marconi invented the audion.

"ANSWER: Audions cannot be said to have all been invented entirely by one man. The vacuum used in modern tubes was discovered some time ago; the first two elements were invented by Flemming and the last one by DeForest. It is not known who invented the prices now in vogue, and for safety's sake, he will probably always remain incog." He comes nearer to it this time than ever before.

"Please give me a hook-up for the following instruments," "Johnny R." requests, "Three dry cells, a galena detector, a telegraph key, a tuning coil, two spark coils and a headset." We couldn't do it, right offhand, but that just shows how sadly lacking we are in an understanding of things radio. The new Radio Editor gives him a hook-up, and it works—splendidly!

As Johnny himself says, "I can hear the spark fine in my phones every time I press the key." You see what education will do, don't you?

It isn't long before the Radio Editor begins to blossom out in regular style. He starts to illustrate his page. Know what we mean?

There are two kinds of radio pictures; one runs largely to feminine pulchritude, especially of the lower section (and sometimes not so low as that!) of the pedal extremities, and the other illustrates scarf-pin sets that have brought in stations from all over the country at the owner's home in Wattown, N. J., said owner appearing bashfully (?) in background. Of course, they are not *all* scarf-pin sets; there are garter, ring, button, stud, watch-case, lead pencil, fountain pen, tooth brush, and other kinds, but—well, you've seen 'em yourself, so why enumerate them?

What we are driving at, though, is that

(*Continued on page 696*)

Radio Humor

MUTT AND JEFF—And as a Radio Salesman, Jeff Is the Robin's Raincoat . . By BUD FISHER

(Copyright, 1922, by H. C. Fisher. Trade Mark Reg. U. S. Pat. Off.)

From the N. Y. World

Radio Rhymes

The "Shoestring" Enterprise

By ROBERT STEWART SUTLIFFE

BILL JONES for many a year had slaved, and had through self-denial saved, until he saw his balance grow, up to five thousand "plunks" or so. And while thus saving made a plan, for using every "iron man"; no flivver 'd ever tempt this sage, the fund should serve in his old age.

His spouse, the type the small town knows, has shared with him his joys and woes; had skimped herself in many ways, for that good fund for future days. And day by day the years rolled by, with many a tear and many a sigh; but when a thing became the rage, she gloried in her "snug old age."

Then came along the Radio, and Bill and Mary came to know the marvels of this "people's friend," with entertainment without end. They heard its concerts, its advice, its what to do and how to price; into their humble lives it seemed, to bring the joys they'd only dreamed.

One day unto their home town came, through Radio, a bid for fame; a neighbor's boy a patent won, was dubbed "The Local Edison." Promoters then, with pockets lean, appeared to paint a brilliant scene, of factories and wealth to be, of work for all;—prosperity. Why hesitate when circumstance, had brought their town this splendid chance! Why, fortune perched within their reach, a life-time opening for each!

And then they dwelled upon the theme of funds to carry out the scheme; announced that in the big Town Hall, a chance for stock should come to all. And Bill and Mary as of old, with visions of a rain of gold, despite of warnings of the wise, invested in the enterprise.

From prehistoric days, alas! this same old game has come to pass; the fools rush in where fear to tread, the wise; and soon the news is spread, of bursted bubble, crash and fall; so Bill and Mary lost their all.

Perhaps some time experience will give our saving folks more sense; folks like Bill may be more rare; but more than likely they'll be there, slaving, skimping—early, late—to meet at last the same old fate.

Program of Station P. D. Q.

The Dumb-Bell Broadcasting Station will at 6:00 P. M. Monday broadcast the following program on a wave-length of 1,000,000 Comets.

If bugs at distant points fail to hear some of these selections they should throw their sets away; they can't be any good.

Inter Ference, personally known to most of you radioists as "Static," will at intervals during the evening give a few selections on the snare drum: "Boilermakers' March," "Machine Shop Blues" and others. He will also, at 9:00 P. M., give an imitation of a freight train wreck.

6:00 P. M. Soup-eating contest between six qualified patrons of Carl Goodman's restaurant.

6:30 P. M. We will be favored by a talk, subject "Burnt Gases" by Exaust Pipes.

7:00 P. M. The United Brothers of the Gasmen's Association will render a gas-house explosion; this number will require no loud speaker. If operators at a distance of 5,000 miles do not hear this selection, let us know and we will call the city powder plant and have the explosion repeated.

7:20 P. M. The poultry house quartet, Brown Leghorn, and Brother "Red" Leghorn, "Hardboiled" Egg, and Will Cackle, will favor us with a selection entitled, "Can a Battleship Hatch?"

7:40 P. M. Shooting of noiseless fire crackers for the benefit of the Deaf and Dumb institutions at various points.

8:00 P. M. Talk "How to transmit with a Ford coil." Beginners are urged to turn out their filaments.

8:30 P. M. We are sorry to say this number will have to be omitted, as Mollie Cule has the flu and can not be seen. Bed-time stories will be transmitted instead. Stories by Goose Down, and "Red" Quilt.

9:00 P. M. There will be a reading by Millie Ameter.

9:30 P. M. If the Moon shows up we will have a man in the moon story.

9:45 P. M. Mag Neto will give a few shocking remarks on "Spark Plugs"; Dyna Mo will also endeavor to throw some light on the subject.

9:55 P. M. At 9:55 P. M. and lasting until 10:00 o'clock, we shall relay the Arlington time signals directly from the Arlington Squeak Box.

10:01 P. M. Market reports by Bull Durham.

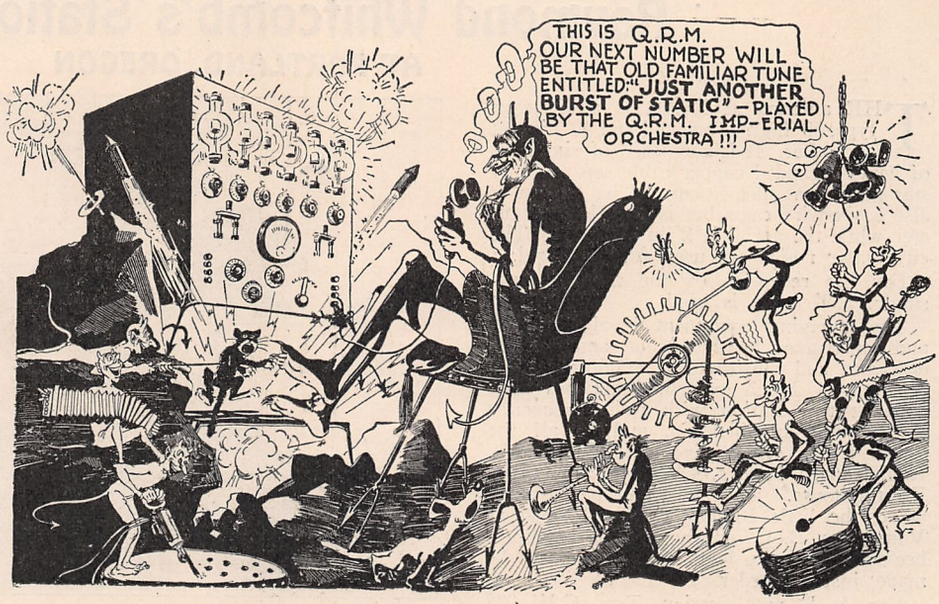
11:30 P. M. Whistling solo by Callie Ope.

12:01 A. M. The barn yard trio, Kittie Catwhiskers, soprano, Tow Eeyow, basso, and Maul T. Highback, bass, will give a rousing selection entitled "Chase me, kid, chase me."

12:14 A. M. P. D. Q. Signing off.

12:15 A. M. Good Night.

Contributed by G. S. DOZIER.



One Station We Have All Heard—By G. B. ASHTON

THIS Department is open to all readers. It matters not whether subscribers or not. All photos are judged for best arrangement and efficiency of the apparatus, neatness of connections and general appearance. In order to increase the interest in this department, we make it a rule not to publish photographs of stations unaccompanied by a picture of the owner.

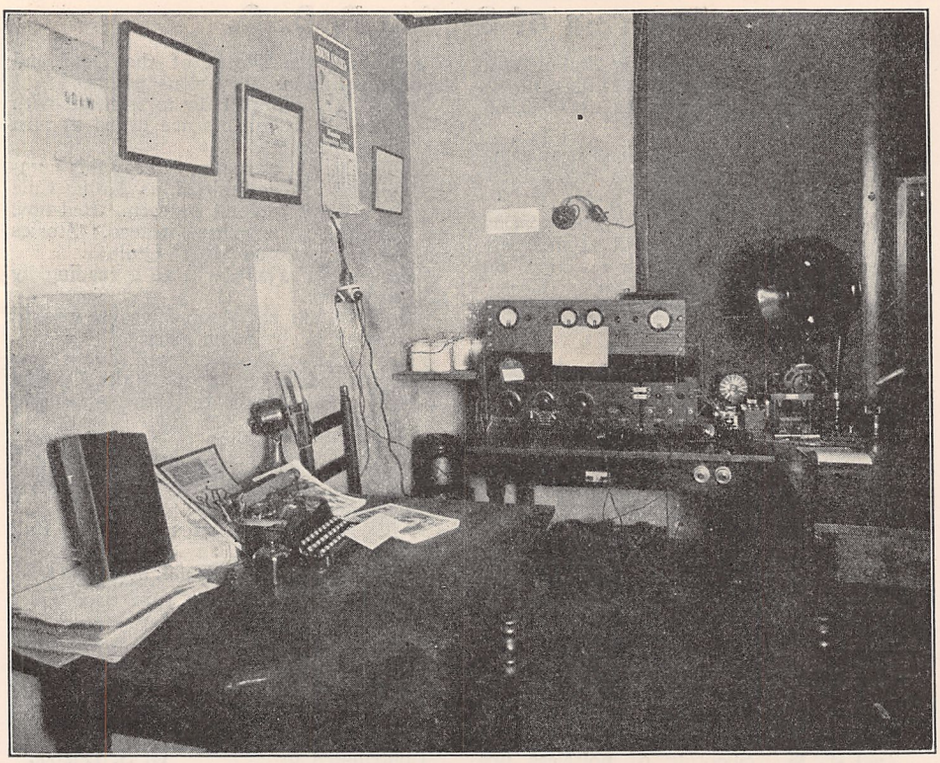
We prefer dark photos to light ones. The prize winning pictures must be on prints not smaller than 5 x 7". We cannot reproduce pictures smaller than 3½ x 3½". All pictures must bear name and address written in ink on the back. A letter of not less than 100 words giving full description of the station, aerial equipment, etc., must accompany the pictures.

PRIZES: One first monthly prize of $5.00. All other pictures published will be paid for at the rate of $2.00.

Walker L. Wellford's Station 5DO

at Memphis, Tenn.

THIS MONTH'S PRIZE WINNER



A Very Compact Station Equipped with Modern Apparatus. Note the C.W. Set Above the Receiver.

HEREWITH is a picture of my station, Radio 5DO, which I would like to enter in the Amateurs' Contest. The following is a description of it.

My transmitting set consists of a 20-watt C.W., using either straight or chopper C.W. All of the transmitting equipment is Radio Corporation except the meters, which are Jewell. The electrolytic rectifier, however, is homemade and the key is a Clapp-Eastham. The rectifier consists of 10 porcelain jars which may be seen in the corner. They supply about 500 volts to the tubes. The chopper consists of a 16-electrode disc revolving at about 2,300 R.P.M. It gives a note somewhat like a spark set.

The receiver is a Grebe CR8 and two-step amplifier, using Baldwin phones, and a Magnavox which may be seen at the right of the picture. I use 100 volts on the plates of the receiving tubes. In order to keep my battery charged I use a tungar rectifier.

I have been heard 1,300 miles on my transmitting set and so far I have worked about 1,000 miles.

(*Continued on page* 790)

Raymond Whitcomb's Station 7AAR

AT PORTLAND, OREGON

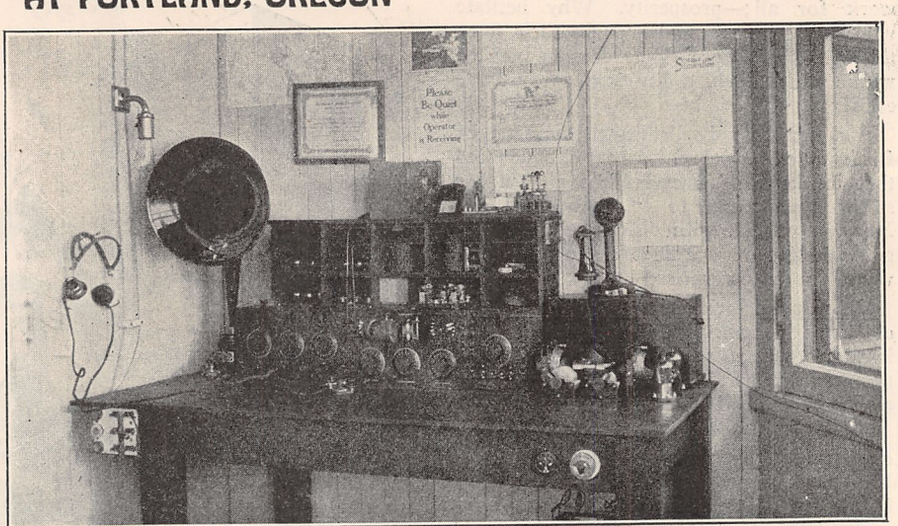
THE antenna at 7AAR is a 35′ cage type, 50′ high at one end and 40′ high at the other. It is composed of six wires of heavy stranded copper cable separated by star-shaped wooden forms. The lead-in is also a six-wire cage, but is only 1′ in diameter while the aerial is 2′ in diameter. The city water mains are used for a ground.

For the reception of the arcs, a long, single, 350′ cable is used.

The receiving equipment is all designed and constructed by the owner, and is fully described and illustrated in another part of this issue. Much experimenting has been done at this station with radio frequency short wave amplification, and of all the tubes tried, which include Mooreheads, Radiotrons, Myer's, Western Electric, Westinghouse, and a war-time French valve, the little British V-24's obtained at Vancouver, B. C., surely win the hand-embroidered high-top boots. They seem to be made just to order.

For A. F. amplification, Type C-W 933

(*Continued on page* 790)



A Very Neat Receiving Station Which is Entirely Homemade. The Apparatus Used at 7AAR are Described Elsewhere in This Issue.

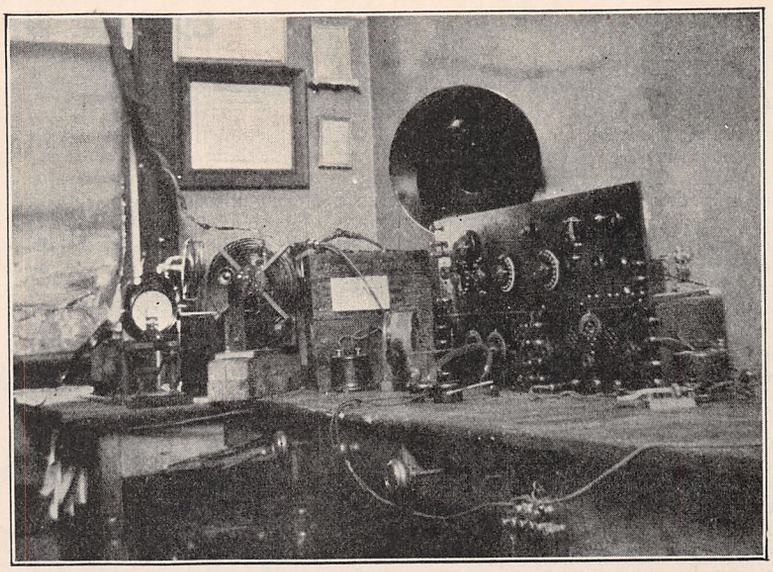
Station 8 BAH at Cleveland, Ohio

I SUBMIT herewith a photo of Station 8 BAH, West Y. M. C. A., Cleveland, Ohio. The transmitter consists of a ¾-K.W. 25,000-volt, Thordarson transformer, glass plate, oil-immersed condenser, "Amrad" quenched gap, and heavy copper O.T. The O.T. is specially built to have a very fine adjustment, which is necessary with a quenched gap.

The receiving set consists of a Regenerative receiver, detector, three-stage amplifier and Magnavox. The coupler at the left increases the efficiency of this set about 25 per cent. It is of the flop-coil type and nearly all of the regeneration adjustment is done with it and the condenser in series with the ground.

The transmitting antenna is a six-wire flat top, inverted "L," 60′ long and suspended 20′ above a four-story building. The lead-in, consisting of six bunched wires, is about 25′ long. The ground, which is not very efficient, but the best obtainable, consists of the water and steam pipes of the building, all the copper eave spouts, and a steel fire escape. Despite this inefficient ground, the transmitter will put from 3 to 6 thermo amps. into the antenna.

Perhaps the most novel feature about this station is the lack of switches in transmitter and receiver, especially the antenna change over switch. Instead a separate, single wire antenna is used for receiving and the transmitter is then connected directly to its antenna and in series with an anchor gap to the ground. This does away with the losses sometimes caused by a change over switch. The switch in the photo is used only to start the fan for cooling the gap, and to close the primary circuit to the transformer.



This Station Uses Two Antennae, One for Transmission and the Other for Reception. The Transmitter is a ¾-K. W. Spark.

Due to transformer trouble this station was not in operation during the winter, but in the time of actual operation since April the set has really shown its worth. Regular communication has been carried on with stations 800 miles distant and a record of 1,500 miles has been attained. Reports state the signals are QSA with slight QSS and break right through the QRM and QRN.

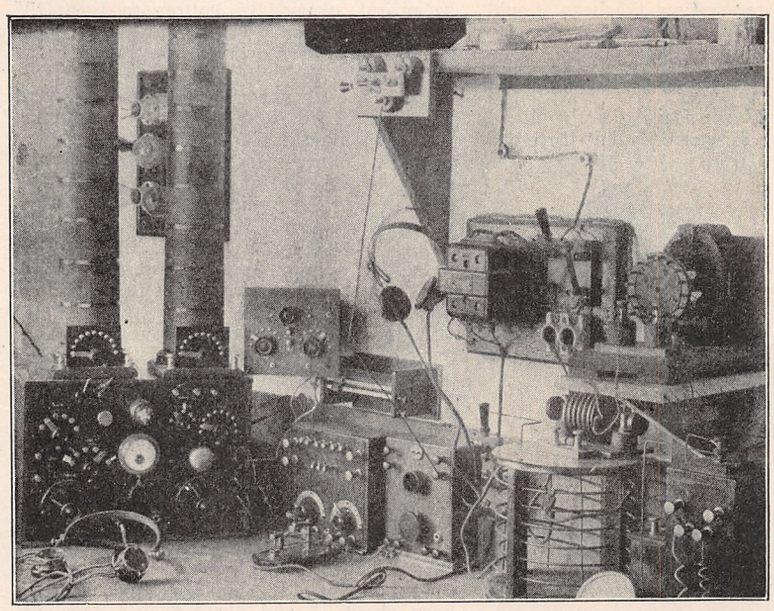
A C.W. set and radio frequency amplifier are now being built and are expected to be in operation very soon. Reports on either the spark or C.W. signals of this station will be greatly appreciated and acknowledged.

HARRY TUMMONDS (SM),
HOWARD ROWE (LM).

Amateur Station at Pernambuco, Brazil

Owned by G. G. GATIS

THE accompanying is a photo of my radio set which is considered out here as the best amateur set in the north of Brazil. I may state that all the apparatus was made and constructed by myself. This includes the panel, receivers, switches, contacts, loading coils, detectors, 1½-K.W. transformer, spark gaps, rotary gap, H. T. condenser, helix, charging rectifier, A battery, B battery (these being made up of small vaseline pots, dry cell principally), and amplifier transformers. The honeycomb coils were also wound by myself, but do not appear in this photo, yet the panel can be plainly seen, next to the regenerative set. The transformer for rectifier, phones and ammeters were purchased with great difficulty out here from friendly OP's whose ships put into this port.



This Station is Considered to be One of the Finest Amateur Stations in North Brazil. The Apparatus is Nearly All Home-Made.

AERIAL

I have two aerials in use. The first consists of an inverted L, four wire, 20 meters long, 12 meters high, which is used to chat with my fellow hams out here (we are now permitted to send), tuned down to 200 meters. The second is of the same type, but is 90 meters long, 20 meters high, slung on masts fixed on trees and used exclusively for long wave and distant reception. Earth consists of the water pipe and plate sunk in well.

RECEIVER PANELS

Three types are used; regenerative panel mounted with bulb and tuned to 150-7,000 meters and 20,000 meters with loading coils connected. In this set, primary, secondary and tickler are all adjustable. The second is a small regenerative set tuned 100-600 meters used by the hams here. The third is a honeycomb tuner with separate valve panel. This valve panel is fitted with amplifying transformers and may be used as a one step or detector with another set. Phones are Western Electric and Fosters and are both excellent receivers. Tubes used are Navy J tubes and Moorheads. Stations on spark and C.W. have been heard many thousands of miles. These sets are all fitted with crystal and may be changed in a moment to either. A double slide tuner may be seen and is used as a loader for tickler and answers its purpose splendidly. A two-way switch is fitted on the aerials so that either may be used as desired. Everything is mounted on ebonite and thoroughly insulated and works O. K. Time signals from sundry stations come in very clearly and well.

TRANSMITTER

A 1½-K.W. 220-V. transmitter, closed core, with three taps (which took me eight months to make) is used and may be seen enclosed in a teak box at right hand corner with H. T. condenser, helix, plain gap, quenched gap and rotary, these being used as desired; the rotary is driven by a small step-down transformer, 220 to 300 V., seen above, which also serves the rectifier to charge my A battery. The note produced by rotary and quenched is high and pleasant, and friendly OP's on board ships say that they can read my signals on ½-K.W. 100 miles or more out at sea. It took me nearly three years to complete this set and I may state I own it with pride considering the hardships I encountered while constructing same.

That Short Wave Set

By C. A. WARD

ARTICLES to help the beginner in radio are appearing in countless numbers in the radio publications, newspapers and elsewhere, and rightly so, for the number of newcomers in the radio art is legion. There are also discussions of the niceties, theories of operation, and more or less complicated and unique layouts of apparatus for the advanced amateur—the fellow who has the inclination, time and apparatus to go into the theory of radio for its own sake and to help in the development of the art. Personally I feel that I belong to neither class and have often heard the same comment from other amateurs.

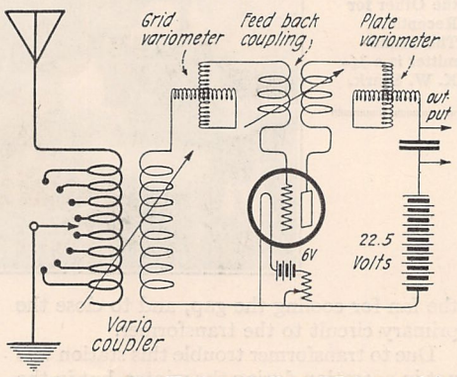
Let me speak for these other fellows when I say that we understand the principles involved in a practical way, that we usually want to have a hand in the construction and installation of our apparatus and that we have the habit of periodically changing our apparatus and circuits for better or for worse—sometimes to the intense displeasure of our listening family and friends. Foremost in our minds, though, are good results—we find it necessary to know the theory of radio, but we are more interested in the doing than in the knowing.

If our radio experience began before the war, its history is probably about as follows, up to the introduction of phone broadcasting:

Loose coupler and crystal,
Loose coupler and audion,
A "tickler hook-up" using the old coupler or honeycomb coils,

Finally the climax in a "short wave set." The latter seems like an indefinite term, but to the amateurs of a short time ago it could only mean one thing—a regenerative set consisting of three tuned circuits using a variocoupler and two variometers.

If we were to carry our history a little way into the future, it would probably have something to do with a radio frequency amplifying system and a loop aerial. However, most of us still look on that short wave set with awe, for we remember those dots and dashes from low power, far distant stations that other "radio bugs" could



This Regenerative Hook-up is Very Efficient and is Particularly Useful for the Longer Wave Lengths

only hear in their imaginations. And when broadcasting started, there were nights when it seemed that the program was in the same room and the sound details of the announcer's voice were almost uncanny. One could hear him draw his breath and make the other little noises incident to speech that remind us of the wonderful reproductions of Harry Lauder's voice on the phonograph. But unfortunately there were nights when programs did not measure up in tone quality to even the cheapest phonograph—especially when our friends dropped in to listen for an evening. Yes, there have been nights when even the sound of a voice of any kind would have been welcome to our ears, and others when signals started to swing and our nerves were so shattered trying to keep in tune that we swung up and copied Navy press just to be sure of something. To make matters more embarrassing, possibly, we stopped in to hear the neighbor's set—one of the new broadcasting receivers—an immaculate little thing with two knobs to play with and possibly a set of dry cells to light its filament, and behold, we hear the whole concert through. Of course, the tone quality isn't in the same class as that from our three-circuit set when it decides to perform, and static is pretty strong, but still we have to hand it to our neighbor for he always gets something and sometimes we get nothing.

From here on I must stick to personal experiences. Possibly they will be repetitions of other fellows' experiences, but they may help others to get the results I am getting now—good results. When I saw my neighbor's set and others like it, I at first decided that the refinements introduced in large scale manufacture of receiving sets for concert reception made possible a set that could not be duplicated by the home workshop except by chance, and we should all remember that this is true, no matter how good our results may be. Later, however, when I found the boys turning out one and two circuit sets that performed almost as well as manufactured ones, and some of

(*Continued on page* 718)

A Paper-Pulp Loudspeaker Horn

By GEO. A. IRLAND

IN looking over the advertisements of any of the radio magazines it will at once be noticed that one instrument which receives considerable space is the horn to which the ordinary head phones may be attached, either a single phone on the end, or two phones, one at each side of the end. These horns are usually made of metal and consequently have a metallic sound which is similar to the sound of the old-fashioned phonograph with a metal horn, and is not agreeable to the listener. The prices of these horns range from $5 to $12. The photograph shows a horn which anybody with the patience to spend a little time on it can make. It will give a good clear reproduction of the sound in the receiver.

The material used is paper; old newspapers are just the thing. These are soaked in water for about three days, one half pound in three quarts of water, and are torn into small pieces and stirred until they make a pulpy mass. To this mass is then added either one tablespoonful of powdered alum and one quart of wheat flour, or one-half pound of ground glue. The mixture is then boiled for about an hour, or until it becomes almost as stiff as bread dough. It is then allowed to cool. As soon as it becomes cool enough to handle comfortably it should be formed into the proper shape.

To shape the horn properly, a pasteboard form must first be made by twisting a large piece of pasteboard to the size of the inside of the finished horn. The one in the photograph was 6″ in diameter at the large end and 18″ long. The small end of this pasteboard should be placed into a ½″ hole in a wood block about 2″ square, and the horn held in shape by sewing up the side where it is joined. After sewing, the horn should be cut off squarely at the large end, so that when standing up on that end it is straight and touches the flat surface of a table at all points.

The pasteboard horn should then be placed on a board about 2′ square so that there are

A Horn May Be Made Cheaply by Using Some Paper Pulp Moulded Over a Form

at least 6″ of margin on each side of the large end of the horn. The pulp is then stuck on the outside of the horn about 1″ thick, beginning at the bottom, either using the hands or a large spoon. After covering the entire horn with pulp the remainder may be placed around the bottom to form the bell. Care should be taken to get the pulp evenly distributed over the pasteboard horn and to make the bell into a good shape.

After the horn has been formed it must be allowed to dry. As it is very thick, this requires a good deal of time. About a week in the sun is necessary for it to become quite dry and hard. After it is hard on the outside it may be removed from the board with a knife and allowed to dry on the inside. When dry, the inside of the bell should be hollowed out so that the wall is the same thickness throughout the length of the horn.

A block must be made for the attachment of the receiver to the small end of the horn. The block which was used to form the end must be removed and a different kind of block put on in its place. This may be either square or round, a little larger than the receiver to be used. A ¾″ hole is bored through the center into which a tube of wood is made to fit; this also has a hole through its center ½″ in diameter. This tube is glued into the block and the horn is cut out with a sharp knife to allow the tube to fit into it. It should extend into the horn about 1″ and glued to it. The side of the block away from the horn should be rounded to fit the receiver used and should be covered with felt having a hole in the center opposite the hole in the block. An old felt hat is just the thing for this washer. A guide for holding the receiver in the proper place should be provided; some small nails will answer the purpose. The receiver

(*Continued on page* 790)

The Construction of a Crystal Amplifier

By MAURICE B. O'NEIL

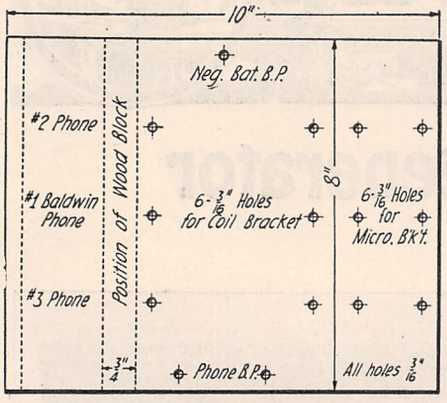


Fig. 1

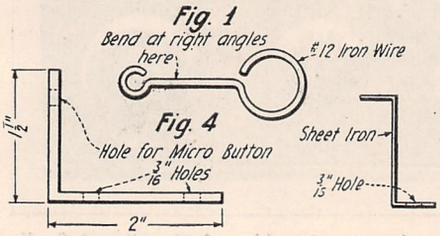


Fig. 4

Fig. 2

Fig. 3

THE amplifier here described, to be used with a crystal detector, has worked more successfully than more than a dozen different types recently designed and tested. After numerous unsuccessful attempts to perfect a more delicate microphone type of amplifier, using sharp edges in microphonic contact with pencil leads, etc., they were all discarded for this one.

When once adjusted this instrument will not jar out easily. I do not mean that it can be thrown about in a careless manner which will of course disturb the most sensitive position of the carbon grains in the transmitter buttons, but it is not as annoying as the more delicate microphone types of crystal amplifiers.

For the construction of a three-step amplifier, the following parts are needed which are easily found in any amateur or experimental station.

Three telephone receivers.

Three Ford spark coils.

Six binding posts.

Three pieces of brass, ¾" wide, 3½" long and ⅛" thick.

Six pieces of thin sheet iron, bent as shown in Fig. 3, ¼" wide.

Six pieces of No. 12 galvanized iron wire for holding coils to base, bent as shown in Fig. 4.

Three telephone transmitter buttons.

Two mandolin "E" strings.

One piece ¾" wood, 8" long by 3" wide. (Not shown in drawings, is used in back of telephone receivers.)

Wood base 8"x10", ⅜" thick.

Wood case 3" deep and 8" x 10" (inside measurement).

The three Ford spark coils are taken out of the coil boxes, care being taken not to break any of the secondary wires. The compound in the coil boxes need not be melted nor the secondary sections taken apart. After the box has been broken away, the primary and core are pulled out and primary wire removed. The core is then wound with six layers of No. 24 D.C.C. magnet wire. The six layers allow a snug fit of the primary into the secondary after the extra two or three layers of waxed paper in the tube have been removed; the three coils are made alike.

The telephone transmitter buttons are drilled and tapped in the shank to allow for adjustment of the tension on the steel wire to the telephone receiver diaphragm, see Fig. 5.

The brass brackets are mounted on the wood base after having been bent and drilled as shown in Fig. 2. The binding post at the end of the base passes through the hole in the brass bracket serving as a connection to it and at the same time to secure it to the base. A small wood screw is used in the second hole in the foot of the brass bracket to prevent side motion of the latter. A hole large enough for the shank of the transmitter button to pass through is drilled in the top of the bracket at a point where it will be in line with the center of the telephone diaphragm when it is in place. These will vary with the different types of receivers.

The small sheet iron standard shown in Fig. 3 is held to the base by the same screw that holds the No. 12 iron wire to the bottom of the base for the purpose of supporting the coils. They should be clamped with an iron bolt. The purpose of this piece of sheet metal is to give an increased magnetic pull on the steel wire between transmitter button and receiver, helping to give a stronger pull on the button and allowing more current to pass through the primary of the spark coils which increase the signal strength from step to step.

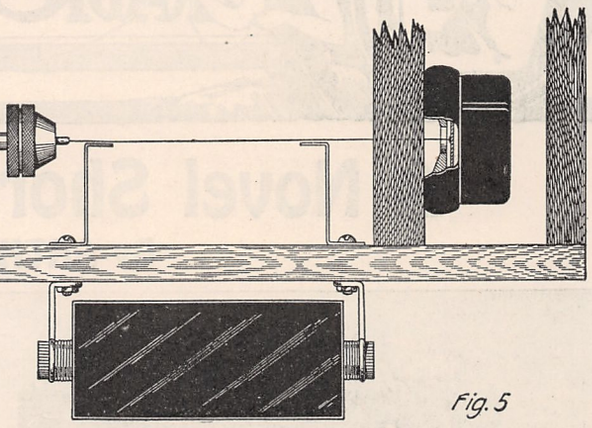
The telephone receiver diaphragms are marked at their center and a small hole punched through with a phonograph needle. The mandolin "E" string is passed through and a very small hook made at the end of the wire, which is then soldered with as small an amount of solder as possible. At the outer edge of the diaphragm, a small wire is soldered and connected to the primary of the spark coils as shown in wiring diagram.

The receivers are placed behind the wooden block and wedged there between the block and wood end-piece shown in Fig. 5.

The other details may be easily understood from the drawings furnished and should present no difficulties to the average electrical experimenter.

Greater amplification may be obtained by the use of higher voltage through the amplifier, but I have obtained best results with a small resistance in series with the negative binding post which will prevent the passage of too great a current, resulting in the heating of the transmitter buttons.

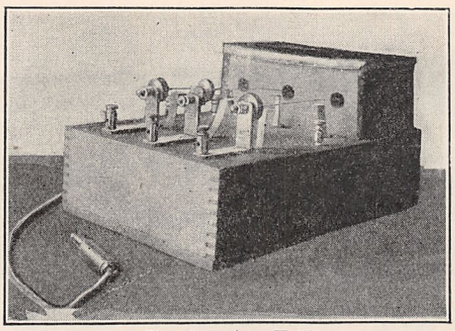
The first step is adjusted until best signal strength is obtained, then the second and third. The batteries may be dry cells. Five cells give good results. The amount of voltage for each step is found by experiment and adjustable clips are used from the three binding posts at the end of the instrument.



On the Right Is a Sectional View Showing the Arrangement of the Parts.

On the Left Are the Dimensions for the Base and Brackets.

Fig. 5



The Complete Unit.

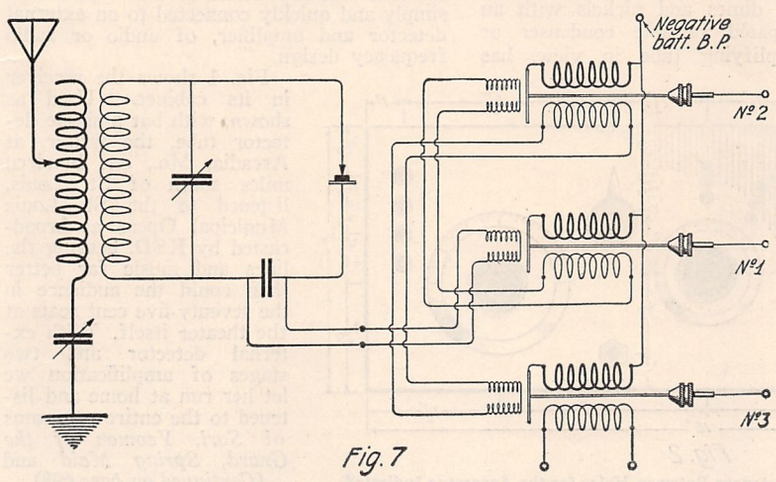


Fig. 7

Hook-Up of the Crystal Amplifier. The Batteries Are Connected to the Binding Posts on the Right.

A Novel Short-Wave Regenerator

By ARTHUR W. LAMBERT, Jr.

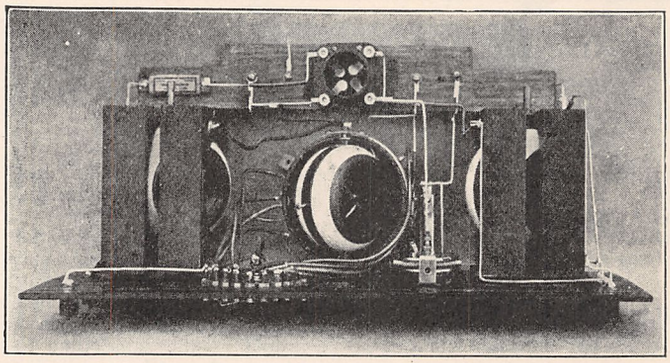
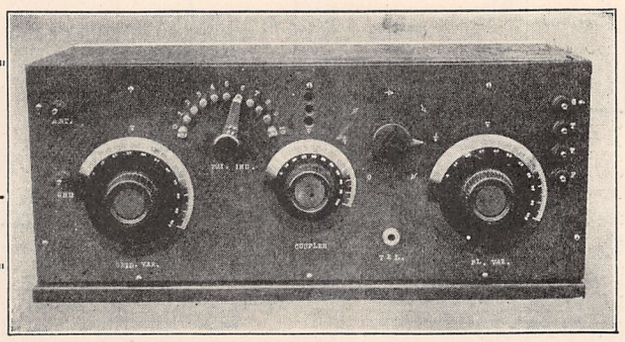


Fig. 1 to the Right and Fig. 5 to the Left Show Front and Back Views of the Completed Short-Wave Set Described in This Article.



WHEN the daily papers and other periodicals first began to broadprint news about radio the general public paused to look at the pictures, possibly read the headlines, then muttered something or other about the "bug-house" and passed on to scan the other items which made up the news of the day.

But when "Mutt" and "Jeff" put in a radio set and Goldberg began to illustrate contraptions like those designed by "Fips" of ancient *Modern Electrics'* fame and the hallucinations of the present Col. G. Ridleak, the public, "always eager for something new," swallowed the bait, hook, sinker and all, and a regular bargain day rush assaulted the radio counters.

Some of the good old crystal detector sets and numerous loose-couplers of pre-war popularity were resurrected from their resting places and after a thorough dusting were exchanged for honest-to-goodness dollars by those who desired to "listen in on the news of the world" at a minimum price.

New manufacturers sprang up over night, and it was rumored that the lead mines worked overtime to supply the enormous demand for crystals.

It was not long, however, before the buying public learned that a galena garage and a tin horn might be all right for Underwood and Underwood to take pictures of (particularly if operated by a sweet young thing with shapely ground connections), but it was a mighty poor outfit as compared to a two-stage amplifier and loud speaker, for supplying music for a radio dance.

In addition to its pictorial value, the crystal detector, like the velocipede, has its place; but, as Shakespeare might have said, "The tube's the thing."

"Yea, verily," responds the would-be radio fan. "But think of the expense!"

Yes, a tube set costs more, but if Mr. Radio Fan will keep the cost of his outfit down to the minimum, he may assemble his own and double the purchasing power of his little tin bank. And the recent boom in radio interest, we think, has cleared up another point. The novice who cares nothing for expense, and who buys the most expensive installation obtainable, tires of it within a few days. Then he has the nerve to broadcast information in his own way to the effect that radio music is scratchy, radio speeches and lectures poor, and that radio in general is still far from perfect, impracticable, and not what it is cracked up to be.

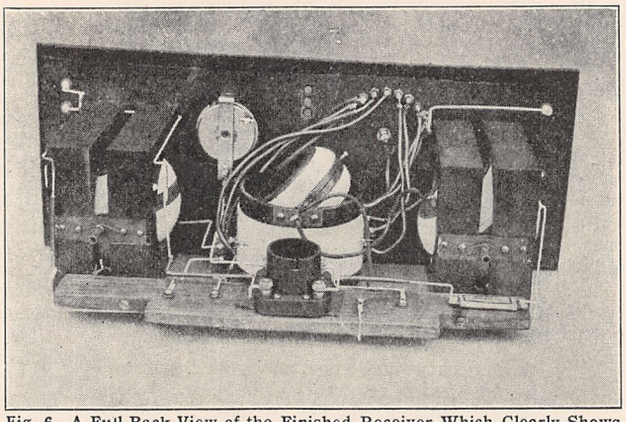


Fig. 6. A Full Back View of the Finished Receiver Which Clearly Shows the Wiring.

But, on the other hand, the fellow who has saved his dimes and nickels with an eagerly anticipated variable condenser or additional amplifying tube in view, has purchased a few bits of "junk" and finally succeeds in actually hearing signals—he has a different story. He tells what he has accomplished through his own efforts. He is the fellow who radiates the real enthusiasm of radio.

And he progresses, building and rebuilding his outfits, until before long he hears distant signals that his moneyed contemporary never could bring in.

And then the fun commences. "Faker" wails the purchaser of the hand-rubbed, nickel-plated beauty to the dealer who sold him his set. "I paid over two hundred dollars for my outfit, and I can't hear a thing; yet the kid down the block who made his own set has no trouble hearing Catalina Island and Pittsburgh."

As George Ade would say: "MORAL—Build your own."

The accompanying figures and illustrations show how any amateur or novice, with the aid of very few tools and little constructive ability can construct a complete receiver of the good old variometer type. And he will find that it not only works as well as the most expensive similar outfit that money can buy, but that it will grace the operating table at any station and be a source of pride to the builder.

Although this tuner and detector unit is a complete receiver, the set is designed as the first unit of a series of units. It can be simply and quickly connected to an external detector and amplifier, of audio or radio frequency design.

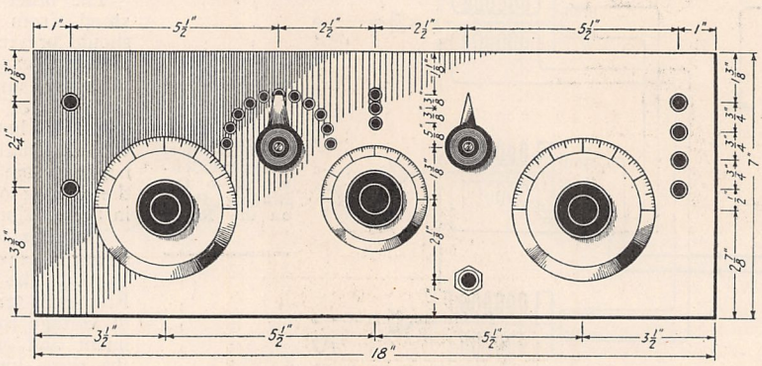


Fig. 2

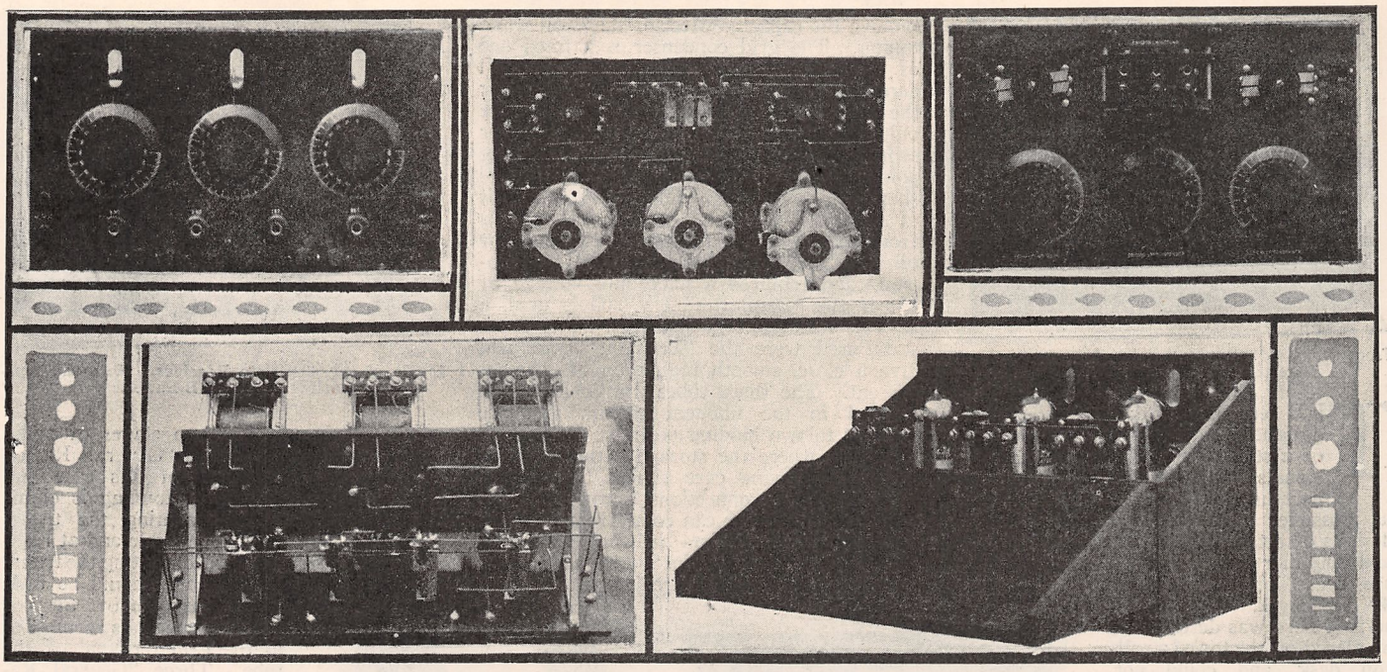
Front of the Panel with All the Distances Between Holes for the Apparatus Indicated.

Fig. 1 shows the receiver in its cabinet. Used as shown, with but a single detector tube, the writer, at Arcadia, Mo., one hundred miles south of St. Louis, listened to the St. Louis Municipal Opera as broadcasted by KSD, hearing the lines and music far better than could the audience in the seventy-five cent seats at the theater itself. With external detector and two stages of amplification we let her run at home and listened to the entire programs of *Sari, Yeoman of the Guard, Spring Maid* and

(*Continued on page* 698)

Details of an Efficient Universal Receiver

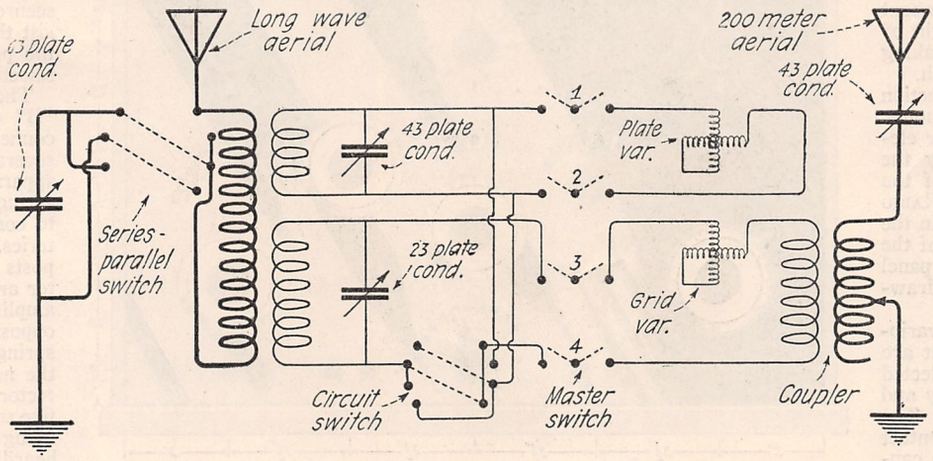
By RAYMOND WHITCOMB



Above Are, from Left to Right, a Front View of the Three-Stage Amplifier, and a Back and Front View of the Tuner. The Lower Pictures Show Two Inside Views of the Amplifying Unit, Which Is Well Designed. Below, the Diagram Illustrates How a Separate Circuit May Be Compared with the Tuner.

THE radio receiver described and illustrated in the following article was designed and constructed by the writer and has been in use at 7AAR since June, 1921. It has given splendid results and is proving entirely satisfactory from the standpoints of efficiency, convenience and appearance.

As may be seen from the photographs, it is in three separate units, viz., a honeycomb coil universal tuner, an audion detector and a three-step amplifier. In the original plans was included a variometer short wave set, but the honeycomb coils gave such satisfactory results when properly handled that the fourth unit was never constructed.



For test purposes, a three test-circuit regenerative variometer set was connected in and both tuners were tuned separately to a long-distance station. Using the "zero beat" adjustment of the honeycomb coil set, and using regeneration on the variometer set at a point where the signals were almost mushy, no difference in the signal intensity given by the two sets could be detected, as the tuner master switch was shifted first to one side and then to the other. If anything, the honeycomb coil set was the more selective of the two.

The master circuit switch is very handy in testing out new hook-ups (radio frequency amplification, etc.) and comparing them directly with the standard tickler circuit. The writer usually has some test circuit hooked onto it and would not be without it for a great deal. The special three-circuit switch also adds flexibility to the set by allowing a tickler regenerative, an ultraudion, or a straight audion circuit to be used at will.

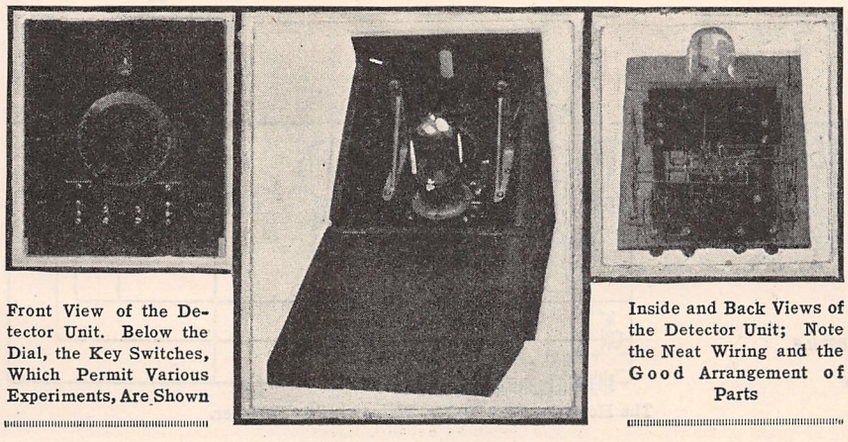
Another switch permits the use of the primary condenser in series or shunt with the primary coil, or short circuits it entirely, while two others make and break the filament and plate circuits. A variable condenser shunted across the tickler coil gives a sort of vernier control of the regeneration and is very useful in the zero beat method of tuning, which should be mastered if really excellent results are to be expected from honeycomb coils. This method consists essentially of so adjusting the set that the frequency at which the tube oscillates is the same as the frequency of the incoming oscillations. This method gives the wonderful amplification of the heterodyne effect without the beat note which would ruin the reception of speech and music and give spark an unnatural tone.

I believe that the photographs are sufficiently clear to illustrate the general construction of the set without a detailed explanation, and exact measurements of the panel layout are not given for the reason that each one will want to use different types of apparatus in its construction and lay out the panels in order to accommodate them. A cardboard template should be made before drilling the panel.

The panels are of ¼" bakelite, and each unit is mounted entirely and rigidly on its panel so that it may be removed from its cabinet for inspection or change. The coil mounting is a De Forest, the variable condensers are Clapp-Eastham balanced type, the transformers are Acme, the rheostats are Paragon, the jacks are Western Electric, the grid leak is an R. C. and the fixed grid and phone condensers are Grebe.

These types need not

(*Continued on page* 746)

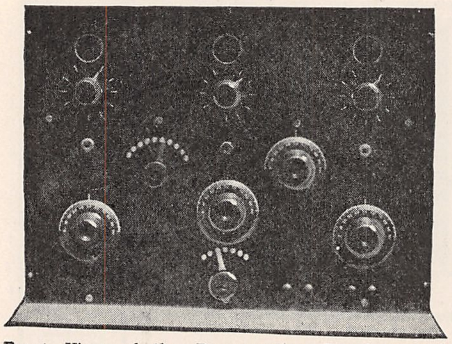


Front View of the Detector Unit. Below the Dial, the Key Switches, Which Permit Various Experiments, Are Shown

Inside and Back Views of the Detector Unit; Note the Neat Wiring and the Good Arrangement of Parts

A Compact Radio Receiving Set

By PAUL G. WATSON



Front View of the Regenerative Receiver with Detector and Two Stage Amplifier.

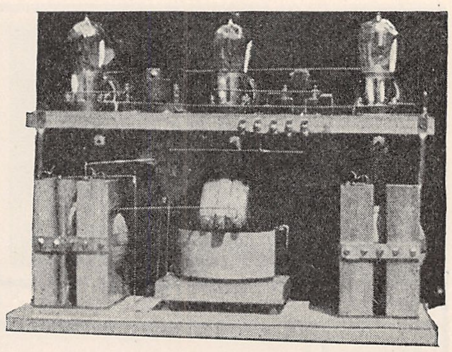
THE receiving set described here was designed to meet the requirements of a store, where the loudest possible signals could be had with the apparatus taking up as little room as possible. There are numerous other designs of sets containing the tuner, detector and amplifier in one cabinet, most of which are great long cabinets, measuring up to 40" in length. The set described here was designed to be placed on the top of a roll-top desk, and could not, therefore, take up very much space. The space required for this set is about 10" by 20", with a height of 16", the extra height making up for the short length.

The general construction may be seen in the photos. The circuit of the tuner element is that given by the writer on page 1188 of the June, 1922, issue of RADIO NEWS, and is included in the diagram. The spacing of the various pieces on the panel is shown in the detail drawing of the panel.

The variometers and variocoupler used in this set are the "Simplex" type, selected for their high efficiency and selectivity of tuning. The necessity for a good contact to the moving elements cannot be exaggerated, and is well taken care of in this type of apparatus. No sounds are heard in the phones when tuning with these variometers, as there are no brushes to cause them. In wiring the coupler primary only the large steps are used, the short wave condenser will handle the close variation of the primary more efficiently than the single taps. The short wave condenser is a 43-plate condenser, of .001 Mfd. capacity. The proper use of the condenser and taps will give a very closely tuned circuit.

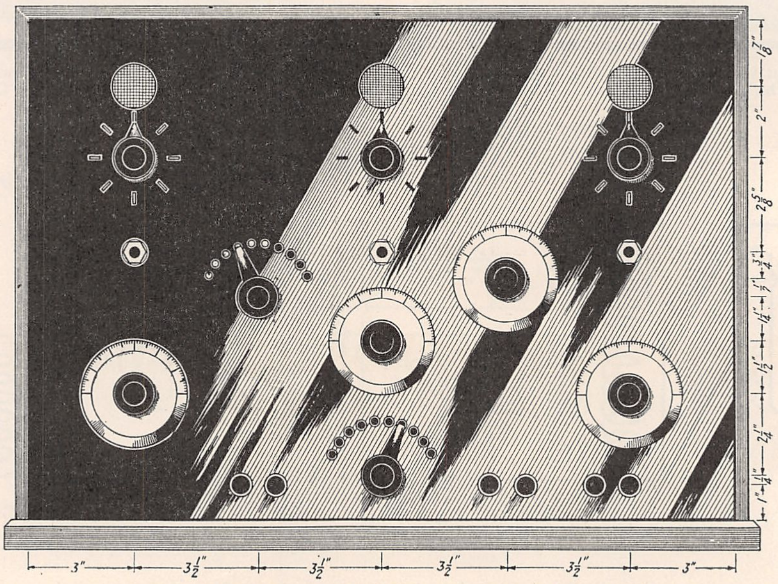
The only variable elements in the secondary circuit are the variometers. The grid variometer should have shielding placed on the back of the panel and connected to the ground terminal of the tuner. This shielding is nothing more than a piece of tinfoil about seven inches square, fastened to the back of the panel with shellac, and insulated from the variometer. This shielding will remove the capacity effect of the hand while tuning. The grid condenser is a fixed one of .0005 Mfd. and a grid leak is shunted across it. The "B" or plate battery for the detector is a battery having variable voltage. Variation is made by the upper switch on the panel. In connecting the points of this switch only alternative points should be used, thus avoiding a short circuit of sections of the battery as the lever passes from one contact to the next. The detector tube used in this set was a pre-war "Audiotron" and required a maximum voltage of 45; if the "Radiotron" UV 200 is used, a 22 volt maximum is sufficient. The rheostats used were the "Paragon" type, and give a close, smooth regulation of filament current. The three tubes are connected in parallel in the filament circuit, and are brought to two binding posts on the face of the panel where the storage battery is connected. Extreme care should be used to have soldered connections throughout the set, so that no noise can come from the poor connections and joints in the connecting wires. "Federal" jacks were used in the detector and amplifier circuits, as they give good tight contact when the plug is removed. Poor contact in the jacks will give an unlimited amount of trouble, and cannot be overlooked as a point where trouble can start. Two double circuit jacks and one single circuit jack are needed, the single circuit being used in the last step of the amplifier. In soldering the connections on the lugs of the jacks, care should be taken to keep the soldering paste out of the insulation.

Two transformers are required for this



Inside of the Complete Receiver. Note the Connectors for A and B Batteries.

amplifier, since it has two stages of audio frequency amplification. "General Radio" transformers were used in this case and worked extremely well. Howling is eliminated completely by mounting the transformers as far apart as possible and at right angles to each other. In connecting the transformers of any make, care should be used to see that the out turn of the secondary is connected to the grid terminal of the tube. Three "General Radio" sockets were used in this set, the contacts being secure and the ability to resist the action of heat being the points considered in the selection.

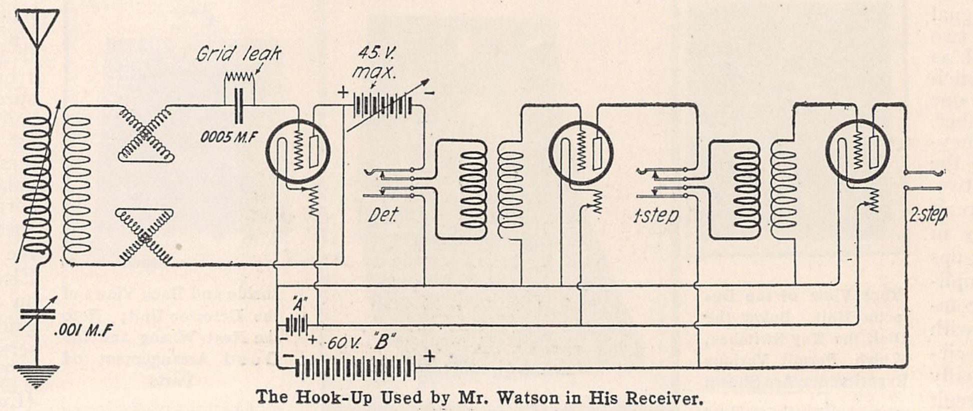


Layout of Front Panel with Distance of Holes to be Drilled.

The manner in which the "B" or plate batteries are connected is one taken from several types of commercial apparatus. "Fahnenstock" spring binding posts are used to connect all the plate batteries. The two large size posts on the one variometer are the terminals for the amplifier plate battery. The opposite variometer has one spring binding post which is the negative post of the detector plate battery. The five small spring posts placed along the edge of the upper board are the connections for the taps of the variable battery which has been mentioned previously. This method of connecting both batteries assures a firm contact at all times, and removes the possibility of noise from this source.

All wiring in the set is to be done with No. 14 bare wire, using spaghetti insulation when necessary. The use of wire as large as this may seem unnecessary to the layman, but it can be pointed out, as examples of this point, that all commercial and military apparatus is thus wired, and again a comparison of the tuner wired with small wire and then rewired with the larger, will convince the experimenter of the necessity of the large wire. The possibility of short circuit is lessened by the fact that No. 14 wire is stiff enough to remain in position when once placed.

The lower board or base of this tuner is about 19" long. On it are (Cont. on page 790)



The Hook-Up Used by Mr. Watson in His Receiver.

The Construction of a Loop

By FREDERICK RUMFORD

A COMPLETE description of a simple and efficient loop aerial is set forth in this article.

The use of a loop is to be recommended if heavy static or local interference is experienced. Static may be reduced to a minimum and by revolving the loop it is possible to eliminate interfering stations. Although for best results on one tube an outdoor aerial is a necessity, a loop is quite efficient if used in conjunction with the proper apparatus.

Only one control, a shunt variable condenser, is required for tuning. This simplifies the circuit and is, therefore, of special value in a portable receiver.

If the loop is revolved over a 360-degree scale while listening to a distant transmitter, two points of maximum audibility will be heard and likewise two settings will bring in the station with the minimum signal strength. The minimum setting is more accurate than the maximum and is generally used. The direction of the transmitter is in a line with the plane of the wire, when the minimum signal strength is found. This is the bilateral method and has the disadvantage of not permitting the determination of the true or absolute direction of the transmitter. By co-ordinate operation of two or more coil stations, this defect may be partially overcome. The unilateral method employing a vertical non-directional aerial in conjunction with the bilateral loop is used at most direction-finding stations on the coast.

When a ship asks the direction-finding station for a position report, the direction-finding loops at the two or three sub-stations are maneuvered until each sub-station has a "line" on the ship. The degree of each sub-station "line" is telegraphed to the direction-finding station and thence by radio to the ship.

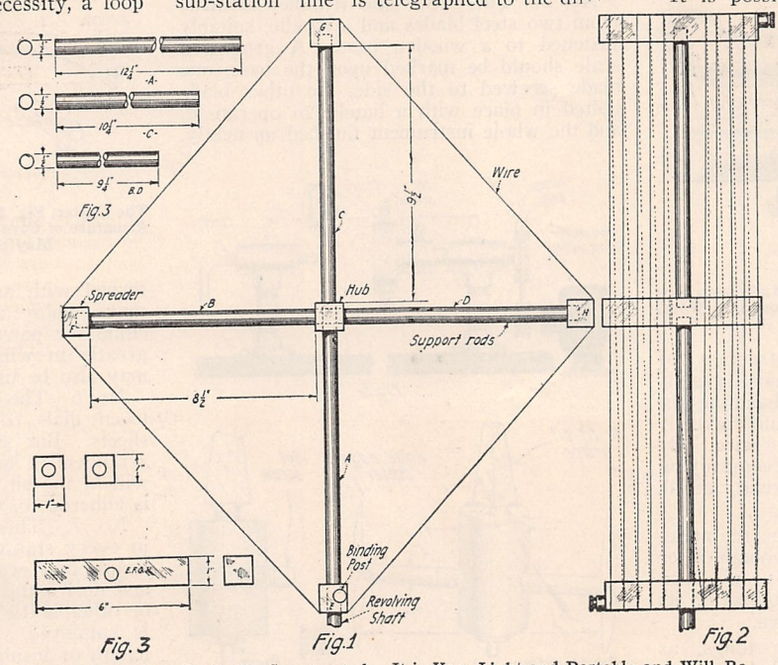
An interesting experiment is to obtain a bearing on the ship while it is transmitting and check the results obtained with those of the direction-finding station. In most cases, they will be found to coincide, especially so after the amateur has gained some experience in this work.

It is possible to locate an unlicensed or interfering station, if three or more amateurs, equipped with loops, take bearings and combine them. For inter-city and short distance work loop reception at wave-lengths of from 150 to 200 meters makes it possible to almost entirely eliminate interference.

In Figs. 1, 2 and 3, the complete constructional details are clearly shown. The hub, spreaders and supporting rods are cut, drilled, finished off and joined. The hub is a 1″ cube with four ½″ holes bored into it part way. The spreaders are 6″ long cut from 1″ square stock. Grooves are cut into the outer side of each spreader to hold the wire in place. A space of ¼″ should be left between grooves. If desired, bakelite or fiber may be used for the spreaders.

For the support rods either ½″ wood rod, bakelite rod or aluminum may be employed. On all

(*Continued on page* 720)



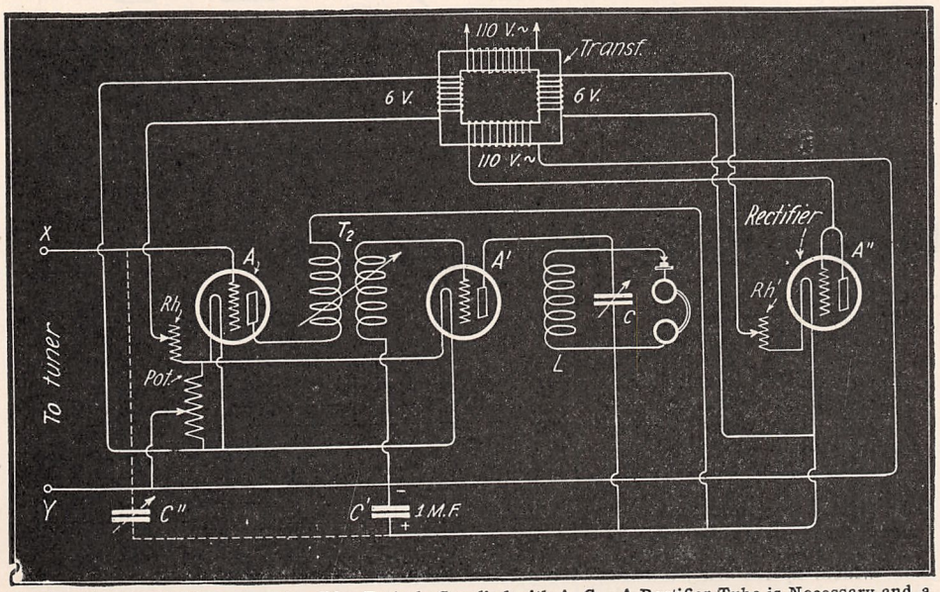
This Loop Can Easily Be Constructed. It is Very Light and Portable and Will Be Found Useful for Many Purposes.

Receiving Broadcasting with A. C.

By Prof. M. MOYE

THE new methods of broadcasting give a distinct revival to the use of crystal detectors, the chief advantage being avoiding the bulky and costly "A" and "B" batteries, especially the former. But crystal reception is not very sensitive for moderate or long distance work and some amplification is always welcome. For the benefit of experimenters provided with A. C. lighting mains, we devised a mixed hook-up (V. T. and galena), which works cheaply and efficiently for wireless telephony or telegraphy.

The set is simply a development of that already described in RADIO NEWS for June, 1921, page 863, with a few adjuncts, especially the coming-down, through a potentiometer, of the return wires of the filament-grid circuits, according to the method of Mr. Reed (RADIO NEWS, January, 1921; page 447).



A Two-Stage Radio-Frequency Amplifier Entirely Supplied with A. C. A Rectifier Tube is Necessary and a Crystal Detector is Used, as it is Not Possible to Use a V. T. Detector.

Perhaps readers may be reminded that the basic principle of the elimination of the humming of A. C. is the use of a tuned circuit in the plate circuit of the last V. T. of the set. This circuit allows a ready path to the very low frequency of A. C., while acting practically as a rejector for any radio frequencies. Those are rectified and made audible, in the ordinary way, by a crystal, as per diagram. The diagram needs only a few explanations: A and A' are V. T. coupled by a radio-frequency transformer and working as radio-frequency amplifiers. They are lighted by A. C. reduced to six volts, a rheostat giving the correct heating. The potentiometer is of any value, between 400 and 1,000 ohms. It does not need to be variable, a middle tap doing as well.

A third V. T., fed by five volts A. C., works as a two-electrode rectifier, grid and plate being connected together. C is a fixed condenser of about one microfarad value, helping to smooth out any ripples of the rectified A. C. If preferred, rectifier and condenser may be dispensed with and a "B" battery connected as usual. It is chiefly the "A" battery which is troublesome to keep in working order and needs a substitute.

The dotted connection and variable vernier condenser C" is not necessary, but it is useful for further amplification and, eventually, C. W. reception.

With the filter circuit L. C. tuned to the on-coming wave-lengths, broadcasting comes quite loud, without any distortion or humming, exactly as when storage-cells are used.

Handy Tools for the Radio Workshop

By G. A. LUERS

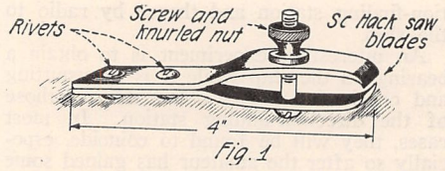


Fig. 1

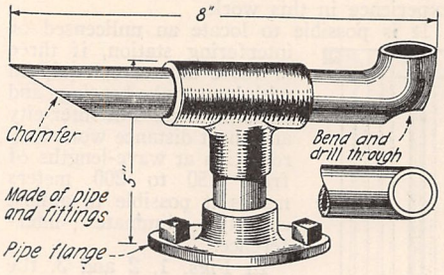


Fig. 2

Fig. 1 Shows a Pair of Tweezers Made from Saw Blades. Fig. 2, a Small Anvil Useful for Light Work.

NEATNESS in the construction of radio equipment depends greatly upon the facilities for handling the metal parts, panels and wiring and correctly shaping each instrument or wire. By making the tools shown in the accompanying sketches the amateur will be greatly aided, by their use, in building his set.

Eight types of tools are shown, the material for which may be readily obtained or found among the contents of the tool box. Each tool will prove indispensable after its use has been learned and mastered.

No. 1. The small tweezer tongs, as shown, are made up of saw blades and a screw terminal. Obtain two lengths of hack saw blades, bend them to shape, drill for the screw terminal and rivets, then assemble. Small machine screws and nuts may be used instead of rivets, if desired. The tongs will prove very useful when soldering or assembling light apparatus. A wing nut may be used for faster and easier action.

No. 2 is a small stake anvil of light construction. All parts are made from pipe or pipe fittings. As is clearly indicated, the base is made from a pipe flange, into which is screwed a small pipe upright, to the top of which is fitted a T joint. The cross pipes are cut and drilled, screwed into the T joint and the instrument is finished. I have found that a height of 5 inches and a length of 8 inches is to be preferred. In building up rheostats, coils, placing rivets and soldering, this tool finds a useful place.

No. 3. The cutter and trimmer is made from two steel blades and a handle, suitably fastened to a wooden base. A graduated scale should be marked upon the base, one blade screwed to the side, the other blade bolted in place with a handle to operate it, and the whole instrument finished up neatly.

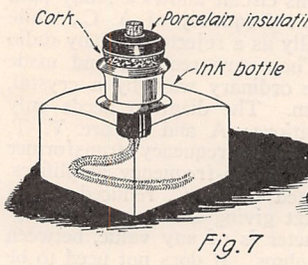


Fig. 7

A Little Alcohol Lamp Which May Be Used as a Blow Torch is Useful to Make Apparatus.

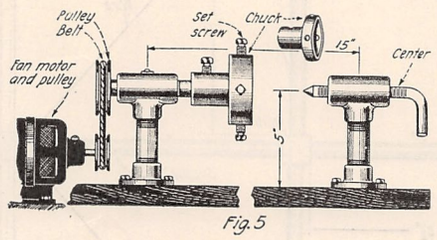
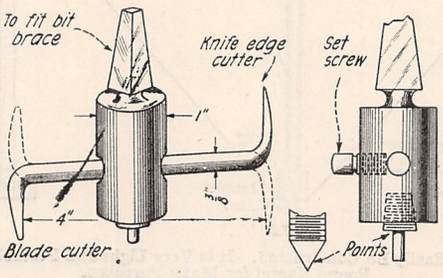


Fig. 5



Above is a Coil Winder Which May Be Built with Pipe Fittings. Below is a Disc Cutter for Making Dials, Condenser Plates, Etc.

This tool will prove handy in cutting condenser plates, shearing iron core stock and other light material.

No. 4. This is a combination saw and file holder. A piece of ½" steel pipe is cut and bent to the proper size and slotted for the blade ends as shown. This holder will enable a firm hold to be had on saw blades or any type of file, either flat or circular.

No. 5. A very simple and easily constructed coil winder may be made as follows: Two end supports should be made first. They consist of a pipe flange, a short length of pipe and a T joint. The supports are separated 15" and securely fastened to the bench, making sure that the openings are in line. One support is equipped with an axle on to one end of which is fastened a pulley. The chuck is fastened to the other end with a set screw. The other support is equipped with a center. The axle may be

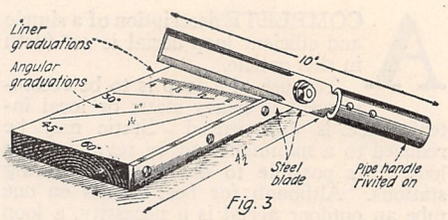


Fig. 3

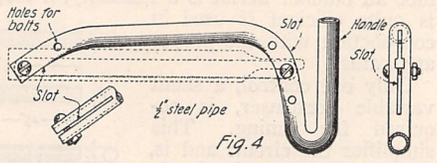


Fig. 4

The Cutter, Fig. 3, May Be Used to Cut Condenser Armature of Cardboard; the Tool Shown in Fig. 4 May Support a Saw or a File.

turned with an electric motor, or the fan may employ the ever-present sewing machine for power. This instrument will aid greatly in winding all forms of coils and may also be used for drilling if desired.

No. 6. The disc cutter shown enables one to cut dials, condenser end plates, etc., from sheets. Bar stock is used throughout, the arrangement being very simple. This tool will fit the bit brace, and, if the size shown is adhered to, will give satisfactory service.

No. 7. This alcohol torch is a necessity in every station, and its construction is so simple that every amateur should make one and derive the benefits therefrom. An ink, or other bottle which will not readily upset, is employed. Drill the cork for a short length of insulating tube, which should then be inserted as shown. The wick may be purchased at any drugstore. Wood or real alcohol, if you can get it, may be used. For every purpose where heat is desired this small necessity will prove of value.

No. 8. The hand knurl and tube cutting tool shown consists of a handle with an adjustable elbow. When using the knurling disc it is possible to tighten up the numerous thumb screws and adjusting pieces. The cutting disc will allow easy grooving or cutting off of metal tubing or solid insulating rod. This device will be found very handy in a large assembling room, and the amateur will never regret the time spent in making this, or any of the other tools described in this short article.

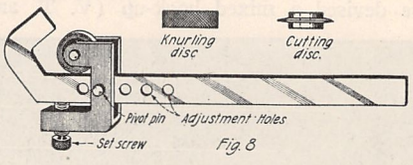


Fig. 8

To Cut Grooves and Knurl Knobs Such a Mounting is Convenient.

How to Wire a Radio Set Correctly

The reason so many constructors make bad jobs of their sets in regard to wiring them is often because they can't solder connections. Soldering is easy once the fundamental secret is learned. The two surfaces to be soldered must be scrupulously clean. They should be bright and lustrous, so that the solder may join them together into a solid unit. However, the least amount of solder compatible with efficiency should be used. A good soldering flux is a necessity. Zinc chloride solution, formed by dropping a few pieces of commercial zinc into a dilute solution of muriatic acid, can be used, or any other of the numerous pastes and solutions on the market. If a paste is used, be careful not to use too much, since it neither aids soldering nor makes a neat appearance. In fact, if the melted flux flows to another connection, a high resistance will be shunted across the two, thus materially affecting the efficiency of the set. A little practice will show just how much flux is best. The paste should be applied so that just a thin coating covers the work, the thinner the better. The "killed acid," zinc chloride, should barely wet the connection. As to the soldering iron, which, by the way, is made of copper, be sure it is hot enough to make the solder flow freely. If it has been heated in a bunsen burner flame, do not heat the iron so much that the flame is colored green by the copper, since this pits the iron and gradually deprives it of its power to retain heat. Moreover, the iron should be "tinned," that is, it should have a thin coating of solder, one-half inch, at the tip. To apply this, file the end of the iron on all sides, exposing the bright metal beneath. Then heat the iron to its usual heat, and apply a small amount of flux to the iron itself; wire solder should then be applied so that it coats the instrument all along the tip. This coat-

(*Continued on page* 791)

Practical Home-Made Condensers

By S. B. HOOD

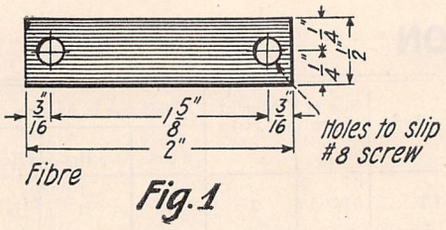


Fig. 1

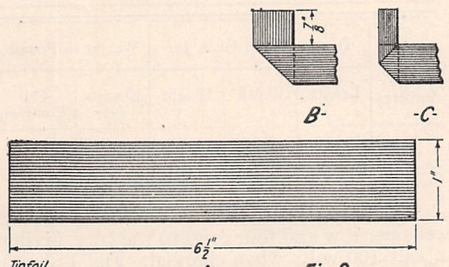


Fig. 2

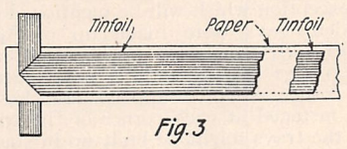


Fig. 3

Showing How the Fixed Condensers are Made with Strips of Paper and Tinfoil.

THE amateur who has graduated from his first crystal set delights in trying every new hook-up he hears about. Since many of these show various forms of fixed and variable condensers, and the hook-up may not work as well as others he has tried, it does not pay to purchase ready-made condensers.

The condensers shown in the accompanying sketches are very inexpensive to make and require only the simple tools to be found in any real amateur mechanic's workshop, and a reasonable amount of mechanical skill, to construct.

The fixed condensers should not cost over five cents each for the material, and the large variable condensers can be built for less than two dollars. Any of them will work as well, or better, than the "bought" variety and the exposed parts will look neat enough to grace any panel.

It will be noted in reading the description that the variable condenser is in reality a combination of a bank of fixed units controlled by a dial switch. The fine tuning is done by a vernier rotating variable unit that bridges the steps of the dial units. The units combined to make the larger variable one can just as well be used individually. Having this in mind the entire condenser requirements for a most elaborate set can be constructed as described.

For the complete large variable condenser as shown, having an approximate capacity of .002 M.F., the following material will be required:

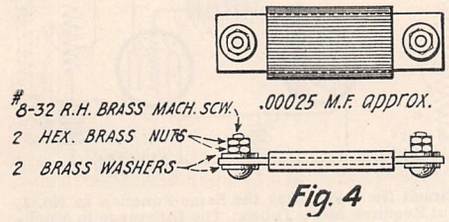


Fig. 4

The Finished Fixed Condenser.

One piece of vulcanized fibre panel stock ⅛" or 3/16" in thickness. (Bakelite or hard rubber will prove equally as good.)

Two inductance switch knobs with shafts and bushings.

Nine switch buttons with nuts.

One switch stop with nuts.

Sixteen ½" No. 8/32 R.H. brass machine screws with two hexagon brass nuts and two washers each. (It is advisable to get some extras for stock fixed condensers while you are about it.)

Two 1" No. 8/32 R. H. brass machine screws with nuts, and about two dozen washers.

Two binding posts with screws and washers.

A small piece of hard sheet brass not over 1/64" thick.

Small sheet of 1/16" fibre, fuller board or press board. (Stiff cardboard will do in a pinch.)

A few sheets of tinfoil. (Save the wrappings from tobacco, cigars and cigarettes and you will always have a stock of this.)

About one-half pound of paraffin wax.

A sheet of paraffined paper. (Tracing paper is ideal.)

A few feet of wire for connecting. No. 14 bare wire is best, as it is stiff enough to stay where it is put; insulated bell wire may be used. If a fancy job is desired cover the bare wire with spaghetti tubing.

The first parts to make are the fixed condenser units. These are shown as approximately .00025 M.F. Their capacity may be varied to suit. While making them, it is better to have a collection varying from .0001 to .001. In figuring these capacities allow one square inch of tinfoil for each .00005 M.F. To this add 1½" to allow for the turned over end that is not active.

From the sheet fibre cut the necessary number of pieces to size, shown in Fig. 1.

Cut two pieces of tinfoil for each, of the size shown in "A" of Fig. 2. Fold one of each first as shown in "B" and finally as in "C." This forms the lug for connecting and does not require fancy cutting of the sheet or waste of foil. Next cut strips from waxed paper, making them ¼" wider than the tinfoil and about 1½" longer.

Stack alternately paper and foil, as shown in Fig. 3. Lay one of the fibre plates on this at the lug end and wrap tightly around it, being careful to see that the paper and foil do not slip and short-circuit the unit. Before wrapping, cut some strips of writing paper the same width as the waxed strips. For this use an envelope cut so that the gummed flap forms one edge of the strip. These need to be only about 2" in length. Wrap one of these around each condenser and seal the flap, thus holding the unit tightly in place.

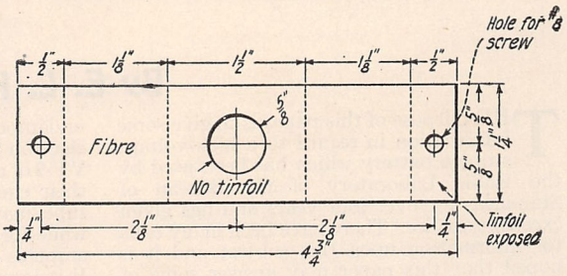


Fig. 5

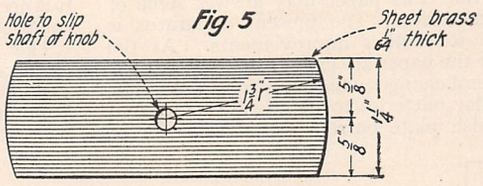


Fig. 6-a

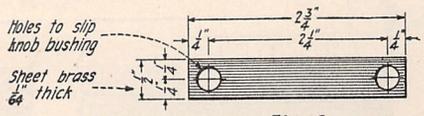


Fig. 6-c

The Elements of the Variable Unit May be Made to the Sizes Given in This Drawing.

Finally bend the connecting flaps around the end of each fibre plate and punch holes for the binding screws. Place the screws in position, with a washer against each side of the strip, and put two nuts on each screw.

The resulting condenser is like that shown in Fig. 4, and is as good as any which can be purchased. But it is not good enough for permanent use, as it is not impregnated and will collect moisture. To guard against this, place the paraffin wax in a glass jelly-tumbler, in a pot of water to boil until all the wax is melted and the glass is about two-thirds full. Immerse each condenser in the melted wax and allow it to remain there until all the air bubbles disappear. Then withdraw and allow to cool.

Before immersing, mark the approximate capacity on the wrapper in pencil or ink for future identification purposes.

To use one of these small units as a combination condenser and grid leak simply place a blank fibre plate on top of the finished condenser unit. Under each washer, and extending a short distance beyond it toward the center of the strip, make a circle with a soft lead pencil. Connect these two circles with a pencil line and the leak is completed. By widening the pencil line the amount of leak can be increased at will.

(*Continued on page* 782)

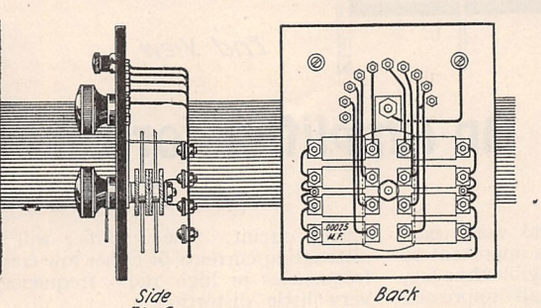


Fig. 9

Here are Three Views of the Complete Unit. Such a Variable Condenser is Cheap to Make and Will Prove Most Useful for Sharp Tuning.

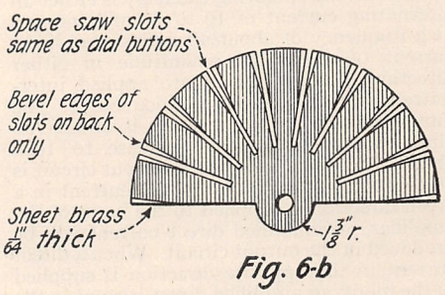


Fig. 6-b

Detail of the Fan Switch by Means of Which Several Capacities May be Connected in Parallel.

Construction of a High-Voltage Storage Battery

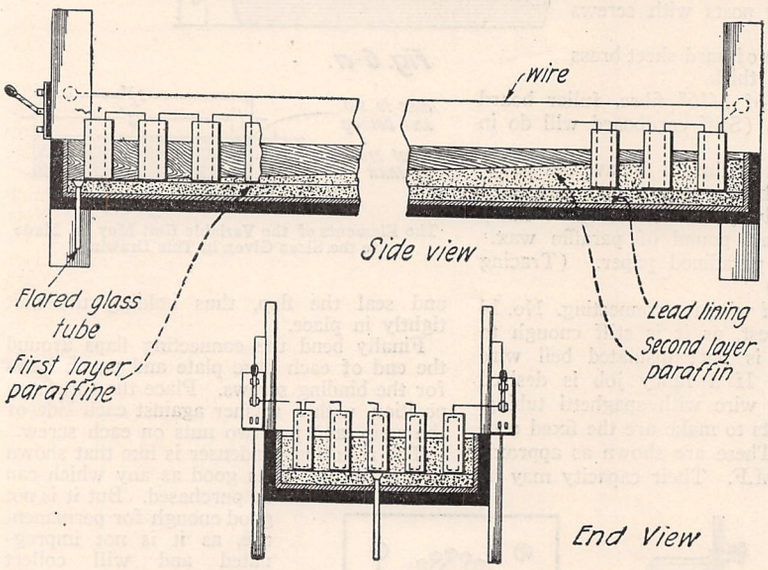
By E. L. HALL and J. L. PRESTON

THE purpose of this paper is to give some information in regard to a high-voltage storage battery which has been used by the Radio Laboratory of the Bureau of Standards for over four years and has given excellent service. There have been many calls for information upon this subject and it is hoped that this paper may answer some of these inquiries. The present apparatus is subject to further improvements. At the close of the paper are given recommendations for several changes which seem desirable. The particular batteries to be described are used to furnish plate current for a generator of undamped radio-frequency currents. The electron tube used is either a Western Electric VT-2 or a General Electric Type P pliotron, or their equivalents. The current for the first tube may range from 5 to 30 milliamperes while for the latter tube it may be 150 milliamperes depending on the plate voltage used. It is necessary that a constant current of small value be available.

The individual elements composing this battery are made by The Electric Storage Battery Company, being their type LT Chloride Accumulator. The following data are taken from the catalog of the above company:

Type	Size of Plate	Number of Plates	Discharge in Amperes For: 8 Hrs.	5 Hrs.	3 Hrs.
LT.....	3½"x1"	2	1/5	¼	2/5

Normal Charge Rate Amperes	Dimensions of Glass Jar: Length	Width	Height	Weight in Pounds: Electrolyte	Cell Complete
1/5	1½"	1⅜"	4⅝"	1/5	¾



This Storage Battery Provides a Voltage of 100 V. and Can Be Used in Reception or Low Power Transmission. The Sloping Layer of Paraffin Permits Overflow of Acid to Run Down to the Drain and Prevents Damage

The batteries were made up using twelve cells per row and four rows to the tray, giving about 100 volts when charged. Fig. 1 shows the arrangement as employed at present with one exception which will be mentioned later. Wooden trays were made up of ¾-inch lumber measuring 11¼ by 19 by 4 inches deep. Legs 1¾ inches long were placed at each corner. Vertical supports 12 inches high were fastened at each corner of the tray so that the trays might be built up in stacks if desired, thus occupying a minimum of floor or table space. The trays were given two coats of black insulating varnish, allowing plenty of time for drying between coats.

Melted paraffin was poured into the tray and allowed to harden. The glass jars, the tops of which had been dipped in paraffin for about an inch down the side, were then put in place and one end of the tray blocked up about two inches. More paraffin was poured in until it came within about one inch of the top at one end and about three inches from the

(*Continued on page* 704)

An Amplifier for Direct Current

By H. A. SNOW

IN various fields in electrical work, particularly in radio work, it is important to have a relay possessing negligible time lag, capable of operating on small impressed currents, of the order of 10 milliamperes. Such a device may be found useful, for example, in recorders for registering telegraphic or radio signals, in apparatus for remote electrical control, in railway signaling work, and for operating an oscillograph from a source of very small current.

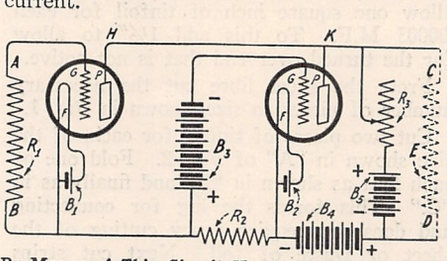
The following paper describes a resistance coupled electron tube amplifier designed to amplify a direct or alternating current of 10 to 20 milliamperes to 110 to 200 milliamperes to take the place of a special type of polarized relay at present used for this purpose. The conditions under which the relay operates and which are imposed on the amplifier follow:

CONDITIONS

The current operating the relay is either an alternating current of 10 to 20 milliamperes at a frequency of about 40 cycles or a direct current of the same magnitude in either direction, both of which are applied intermittently from a high impedance source. The input impedance of the relay is about 750 ohms with an allowable increase to 1000 ohms. The impedance of the output circuit is 50 to 100 ohms. When a direct current in a given direction is supplied to the input of the amplifier, an amplified direct current will be produced in the output circuit. When a direct current in the opposite direction is supplied to the input, an amplified direct current in the opposite direction will be produced in the output circuit. The amplifier will amplify alternating currents of either low commercial frequencies or high radio frequencies with very little distortion.

TUBES

The electron tubes selected for the amplifier tests were UV-202 Radiotron 5-watt power tubes, because of their high filament emission and steadiness of operation with a high plate current.



By Means of This Circuit No. 1, a Direct Current or Alternating Current Can Be Amplified With Vacuum Tubes.

CIRCUITS

Since the electron tube amplifier is essentially a voltage-operated device of high impedance, it is not readily adapted for efficient current amplification. For highest efficiency the highest possible voltage should be produced from the input current it is desired to amplify. The type of amplifier circuit that may be used is limited by the fact that the input consists partially of direct current, to a resistance-coupled circuit employing the voltage drop across a resistance for the input to each stage, so the maximum voltage available with 10 milliamperes flowing in the input circuit is the drop across a resistance in the input circuit. The resistance being limited to 1000 ohms, the maximum voltage available is 10 volts. This requires more than one stage of amplification for efficient use of the tubes.

CIRCUIT DESCRIPTION

Two circuits each having two resistance-coupled stages were set up and adjusted for maximum current amplification. These circuits are shown diagrammatically in Fig. 1.

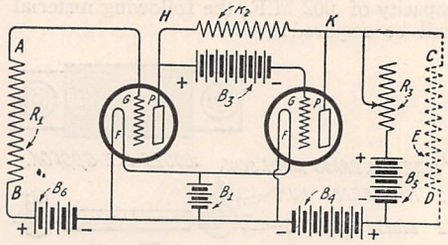
In both circuits 1 and 2 of Fig. 1:

A and *B* are the input terminals.

C and *D* are the output terminals.

E (in dotted lines) represents the impedance of the output circuit. In these tests *E* was a resistance of 50 ohms.

(*Continued on page* 720)



Circuit No. 2 Performs the Same Function as No. 1, but Requires More Tubes. The Difference in Amplification is Due to the Manner of Connecting R-2.

Monthly Laboratories Report

By L. G. PACENT, Director

THE readers of RADIO NEWS were, no doubt, very gratified to read Mr. Gernsback's editorial announcing the establishment of the RADIO NEWS laboratories to encourage the manufacture of better radio apparatus. It is realized that a number of radio manufacturers are putting equipment on the market which is not up to standard but which could be improved with slight modifications and by following the best principles of modern radio engineering. A short time after this editorial appeared, Mr. Gernsback, whom I have known for a number of years, asked me if I would act in the capacity of director of this laboratory. After several conferences, in which he assured me it was to be a national and not a local laboratory, and that the issuance of certificates would be left in the hands of Mr. Lacault, Mr. Clement and myself, I accepted the directorship. The laboratory is now well under way.

Before going into the details of the work which the laboratory is accomplishing, the personnel of the laboratory staff will be outlined.

Mr. R. E. Lacault, Laboratory Director: Mr. Lacault's work in radio is practically unknown in this country but he was in the Radio Service of the French army during the war. He was engaged in experiments in the same research laboratory in which Major Armstrong, at that time with the American forces "over there," performed such wonderful work, including the original development of the super-heterodyne receiver. He has been connected with radio since 1912 and has carried on experiments in its various branches.

Mr. L. M. Clement, Technical Director, is well known to radio engineers, experimenters and amateurs in this country, owing to his long radio experience as an amateur on the Pacific Coast, as engineer for Marconi Company and as radio engineer in charge of Commercial Design for the Western Electric Company, which position he now holds. Mr. Clement was in charge of the installation of the Catalina Island radio link which set the standard for radio communication, both for speed of erection and constancy of operation. Mr. Clement designed a number of instruments during the war while employed by the Western Electric Company and is considered one of the best all around engineers in the country.

Mr. A. F. Toth, formerly of the Western Electric Company, is in charge of the practical work.

The laboratories, although recently established, have received a great deal of equipment for testing the various apparatus submitted. The remainder of the equipment is expected daily. For the testing of radio headsets, we are having especially made for us an oscillator with a range of frequencies from 100 cycles to 10,000 cycles. It will be completed shortly and we ask the telephone manufacturers who have submitted headsets to kindly refrain from wiring us requesting that we rush the test, because we are unable to do so until we get the proper apparatus. We have a standard capacity bridge for measuring capacities of almost any value and hope that the condenser manufacturers will take advantage of this and send in condensers, on which we are ready to issue reports in rotation without a great deal of delay. We expect shortly to receive a standard wavemeter with which we will be able to measure inductances, both variable and fixed. For insulation and other tests, we have ordered a high voltage outfit with A. C. motor generator, together with thermocouples, thermogalvanometers, electrostatic voltmeters and high tension transformers for breakdown tests.

Laboratories for testing various equipment have been in existence for many years, but in the writer's estimation never before has a laboratory of this nature been started for the sole purpose of helping manufacturers. Private reports with constructive criticism and suggestions for improvement will be made to each manufacturer who submits apparatus for test. The weaknesses of the apparatus will be outlined from engineering, operative and salability standpoints. It has never been done before. We have started with this end in view and we will accomplish it. With this in mind, we do not intend to issue a standard certificate for all pieces of apparatus. The certificate will have stamped on the seal the percentage which the particular piece of equipment deserves, as determined by the laboratories. On the back of the certificate the percentage will be enumerated and divided into five classes: mechanical, electrical, salability, serviceability and operation. The totals of each will be shown and also the total percentage. The various percentages are divided as follows:

		Per Cent
ELECTRICAL CHARACTERISTICS		25 (total)
Subdivided:	Design	5
	Efficiency	5
	Accuracy	5
	Operation	5
	Construction	5
MECHANICAL FEATURES		25 (total)
Subdivided:	Design	5
	Accuracy	5
	Operation	5
	Construction	5
	Ruggedness	5
SERVICEABILITY		25 (total)
Subdivided:	General Ruggedness	5
	Material	5
	Packing for Shipment	5
	Life—Probable	10
OPERATION		10 (total)
Subdivided:	Material	5
	Finish	3
	Arrangement of Parts	2
SALABILITY		15 (total)
Subdivided:	Operation	5
	Packing for Shelves	5
	Novelty of Design	5

In cases where the equipment submitted is subject to certain laws or regulations made by the Department of Commerce, the National Board of Fire Underwriters, or other authoritative agency, and it is found that either the apparatus or the accessories do not meet with these laws or regulations, 20 per cent will be deducted from the total percentage. In order to be awarded the certificate, all pieces of apparatus must be awarded at least 60 per cent, the percentage in each class being determined by the Directors, and based upon each piece of equipment after the tests have been carefully made.

In order to facilitate our work we request manufacturers submitting equipment to enclose with the apparatus all literature which they have concerning it, in order that we can make suggestions regarding the description of the goods as well as on the apparatus itself.

The laboratories are entirely controlled by the director and technical director and not connected in any way with the magazine, except that they are financed by RADIO NEWS and that a space is devoted each month to the description of the instruments tested. These descriptions are published for the benefit of the buyers, who are thus informed of the performance of the apparatus which are awarded certificates. Although at present the laboratory is temporarily located in the magazine office, we are looking for a space in a proper location where it will be separated entirely from the RADIO NEWS office.

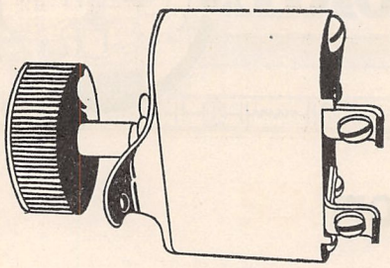
During the last few weeks, various instruments were submitted for which we cannot award certificates. These are not in themselves radio apparatus, but merely accessories, the functioning of which depends upon the kind of apparatus with which they are used. Several of these, although well-made and working well, cannot be tested. Horns are in this category. These are used in conjunction with telephone receivers as loud speakers, but are not in themselves complete units, and will not give the same results under all conditions. For instance, if a good telephone receiver is attached to one of these horns and functions well when connected to a two-stage amplifier, it cannot necessarily be said that the horn is good, for if the latter is used with a poorly constructed headset attached to a regenerative receiver with only one detector tube, the signals will not be loud enough and will probably be distorted, thus rendering the horn practically useless. It is our advice that such amplifying devices, based on acoustics, should be furnished with a reproducer of some sort and accompanied by a pamphlet stating under what conditions the best results will be obtained. If they were so constructed they would be in themselves loud speakers, which we could test, and would be awarded a certificate, if they would work satisfactorily under the conditions mentioned by the manufacturer.

Among the other pieces of apparatus that were rejected were some variocouplers and coils which were not provided with any means of mounting, either on a panel or a table. On some others the taps were entirely too short to permit the soldering of connections, or the windings were loose and not protected from moisture by any kind of insulating varnish. In some couplers the bearings were loose and no stops provided, so that the secondary could be turned indefinitely, making possible the breaking of the connections attached to the stator.

All these points should not be overlooked by the manufacturers, as every poor piece of apparatus put on the market means a dissatisfied customer. It is, therefore, highly desirable that these various pieces of apparatus be manufactured to conform with modern engineering design. It is for this purpose that the laboratories have been installed, and we hope that all manufacturers will take advantage of them for their own benefit.

Apparatus Awarded Certificates

THE BRADLEYSTAT



The Bradleystat, a carbon compression type of rheostat, is manufactured by Allan-Bradley Company of Milwaukee, Wisconsin.

It provides a close regulation of current by tightening or loosening the contact between the carbon discs which conduct the current. This is accomplished by turning the knob clockwise to increase the current and counter-clockwise to decrease it. By turning to the extreme position, the current can be entirely cut off.

The rheostat is well-constructed and is fool-proof, the working parts being enclosed in a porcelain container. An enclosed instruction sheet gives directions for mounting on a panel. Screws are provided for panel mounting.

Approximate size 2¾"x2½"x2⅛" over all.

Tested for 1 hour at 2½ amperes.

Received in good packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT No. 8.

KLOSNER VERNIER RHEOSTAT

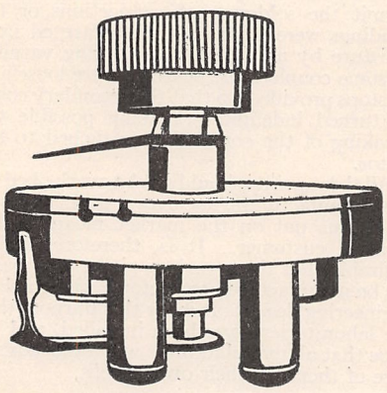
Vernier rheostats are desirable to regulate the current through the critical filament of a gas content vacuum tube. The Klosner Improved Apparatus Company of 2024 Boston Road, New York City, offer their Vernier Rheostat to fill this need. There is but one knob to control both coarse and fine adjustments. The vernier consists of a single turn of bare resistance wire wound on the periphery of the moulded, heat-resisting base, over which the auxiliary arm moves. To change from coarse to fine adjustment, the knob is pulled outward, disengaging the main arm. When the knob is pushed back into the normal position, a pin engages in one of four slots on the main spindle, allowing both arms to rotate. During this movement, the auxiliary arm slides off the vernier wire and runs idle on the rim of the base. Two nickel plated filister head machine screws are provided for panel mounting.

The rheostat is well-constructed mechanically. Total resistance of samples tested was 5.53 ohms.

Tested for 2 hours under 1.25 amperes.

Received in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT No. 9.



KING RHEO-SOCKET

As its name implies, the King Rheo-Socket is a combination of vacuum tube socket and rheostat upon the same base.

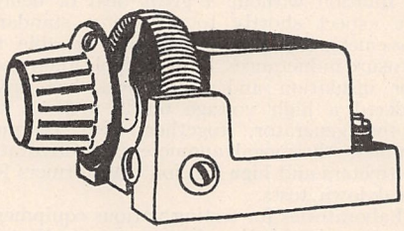
It is manufactured by the American Pattern Foundry and Machine Company, 82-84 Church Street, New York City.

The whole unit is very compact and is made of moulded condensite with metal parts nickel plated. Provision is made for mounting on a panel or table. A neat knob with an arrow in relief controls the rheostat resistance of 5.21 ohms.

Tested for 2½ hours at 1.25 amperes.

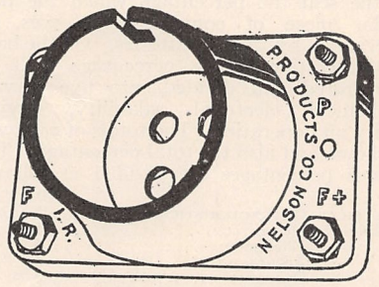
Received in excellent packing.

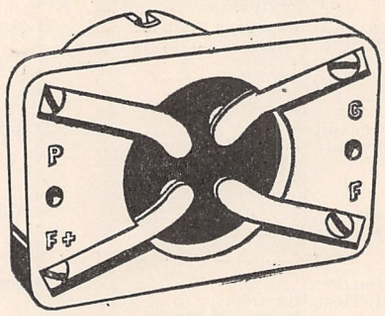
AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT No. 10.



NELSON'S IMPROVED V. T. SOCKET

This sturdy vacuum tube socket made of moulded bakelite is manufactured by I. R. Nelson Company, Inc., of Newark, New Jersey, and is one of the "Reel Easy Products." The socket measures 3"x1⅞"x1⅝". The terminals are clearly marked on both top and bottom of the base. A heavy web is moulded across the inside of the socket with four holes to allow the prongs of the tube to touch on the spring contacts. Metal parts are nickel plated. A well-made socket in every respect.

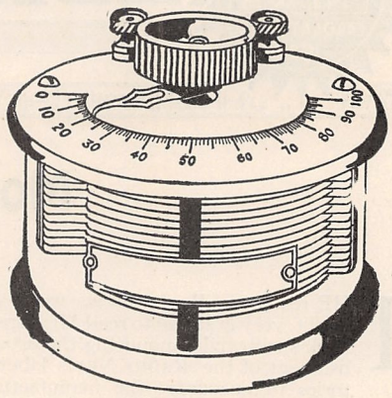




AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT No. 11.

CHELSEA VARIABLE AIR CONDENSER No. 1

In this condenser, made by the Chelsea Radio Company of Chelsea, Massachusetts, the moulded construction insures the maintenance of the correct separation between the medium gauge aluminum plates. Three cast pillars hold the semi-circular stationary plates while the movable ones are rigidly held by an auxiliary casting around the steel shaft, all castings being made of soft metal. The bearings are of brass, moulded into the bakelite ends. Contact to the moving plates is made by a brass strip held against one end of the steel shaft by a set screw which regulates the degree of pressure on the friction contact. The separation between the plates is about .084 inch. A transparent celluloid case surrounds the entire condenser, excluding dust and allowing the inside to be seen.



Over a 100 degree scale moulded on the top of the condenser and filled with whiting, a nickel plated pointer gives the relative capacity in the circuit. As measured on a capacity bridge, the maximum and minimum capacitance of the sample submitted for test were found to be 1086 micromicrofarads (.001086 Mfd.) and 29.8 mmf. (0.000029 mfd.), respectively. Two heavy nickel plated binding posts are provided for connections as the condenser is not intended for panel mounting.

Overall dimensions are 4⅜" diameter and 3⅜" high.

Received in good packing

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT No. 12.

CHELSEA VARIABLE AIR CONDENSER No. 3

This condenser, made for panel mounting, is provided with a counterweight to balance the movement of the movable plates about the shaft. It is manufactured by the Chelsea Radio Company of Chelsea, Massachusetts. The end plates of ample proportions as well as the dial and knob furnished with the instrument are of moulded bakelite. By means of a soft metal casting, the plates are secured to a steel shaft running on brass bearings. The inside is of the same moulded construction as the No. 1 type Chelsea condenser.

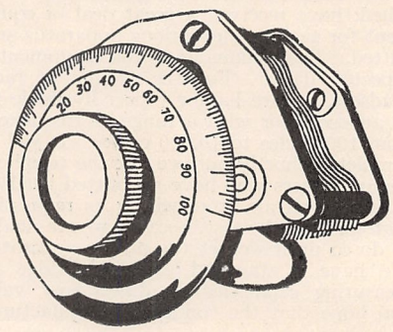
Three threaded brass inserts are moulded into the end plate for the purpose of mounting on the panel. Overall dimensions are 4½"x4"x4⅜". The dial which accompanies the condenser reads from left to right and bears 100 divisions, filled with whiting. The capacitance, as measured on a capacity bridge, was as follows:

Maximum 1136.6 micromicrofarads (0.0011366 mfd.).

Minimum 20 mmf. (0.000020 mfd.).

Received in good packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT No. 13.



A Set for the Radio Novice

By RODNEY ROACH

THE broadcasting of news, weather reports, music, and even plays by the large radiophone stations of this country, such as WJZ, has turned many people to radio as a form of entertainment. Boys as young as ten and men as old as seventy have become interested in the greatest hobby of the times. There is a need for an inexpensive and good audion set for these enthusiasts. Many are using crystal sets for the reception of broadcasted music, but an audion set is far better. The chief drawback, though, is the high cost of such a receiver. It is to an inexpensive regenerative set for the radio novice that this article is devoted. This set is an excellent receptor of music, is of simple construction, and lastly, is of low cost—$13 in all. By building this receiver the constructor will save money, give himself a good set, and gain much valuable experience.

A LIST OF MATERIALS NEEDED

1 tube socket	$1.00
1 rheostat	1.00
Variable condenser	2.15
2 dials	2.00
2 switches	.80
20 switch points	1.00
8 binding posts	.80
Cardboard tubing	.40
1 grid condenser	.35
Wire	1.50
Wood	2.00
Total	$13.00

THE CIRCUIT

Fig. 1 shows the circuit employed. A is the aerial and G is the ground. LP is the primary and LS the secondary of the vario-coupler employed. L is a secondary loading coil, while VC is a 13-plate variable condenser. X is a grid condenser such as is on the market today. C is a fixed condenser of special construction. B is the high voltage battery and A the filament or so-called storage battery. PH designates the phones.

CONSTRUCTION OF THE COUPLER

The coupler used in this set is a sort of vario-coupler and is of very simple construction. The primary is made from a cardboard or formica tube 4½" in diameter by 2½" in length. If a cardboard tube is used, it should be shellacked well (before winding on the wire) to prevent it from shrinking; 27 turns of No. 24 double cotton covered wire are wound tightly on the tube. Taps are taken out every third turn and brought out to the 9 point switch on the panel as seen in Fig. 3. The set functions better without shellacked windings, but if the wire will come loose without it, apply a very thin coating of shellac.

The secondary is wound on a tube 3½" in diameter by 1¾" in length, and is wound with 30 turns of No. 26 double cotton covered wire; no taps are taken off.

Fig. 2 shows the method of mounting the coupler. As is seen, the primary is fastened to the panel and to the base by screws. A disc of ¼" wood is fitted inside the secondary tubing of the coupler and to this a copper arm is fastened by means of screws. As the dial controlling the coupler is moved, the arm moves, thus drawing the secondary in and out of the primary.

THE LOADING COIL

The loading coil L in Fig. 1 is made on a tube 4½" in diameter by 5" long. It is wound with 100 turns of No. 26 double cotton covered wire and taps are taken off every ten turns and brought out to the ten point switch on the panel. In Fig. 1 is shown a wire connecting the last tap of the loading coil with the switch. This is a device that eliminates the "dead-end" effect.

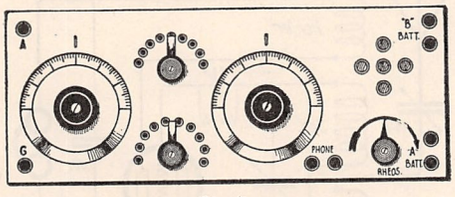


Fig. 3

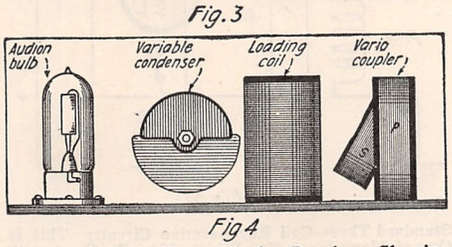


Fig 4

Front and Back Views of the Receiver Showing Location of the Apparatus.

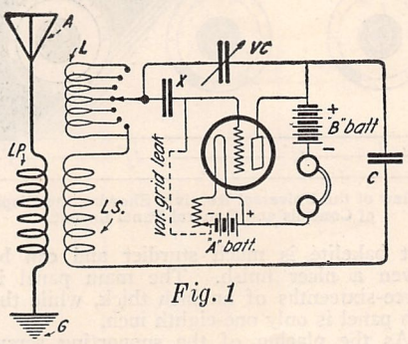


Fig. 1

Wiring Diagram of the Simple Regenerative Receiver Described in This Article.

THE CONDENSERS USED

The variable condenser used in this circuit is of small capacity. It is a 13-plate panel type condenser. The writer uses a 13-plate "Illinois" condenser, which can be purchased for $2.15, and is of good construction.

C in Fig. 1 is a fixed condenser. This is made by covering a piece of mica 2"x3" on each side with tinfoil. A wire is soldered to each of the two pieces of tinfoil and serves as terminals of the condenser. The whole thing is soaked in paraffine, which makes a very neat and efficient condenser.

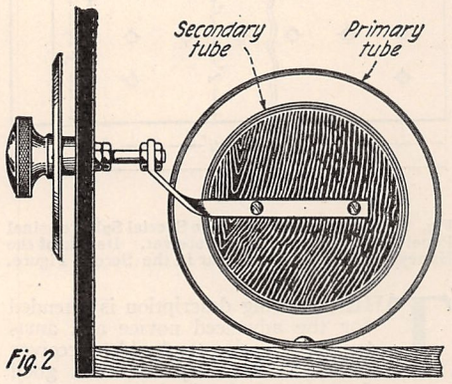


Fig. 2

The Method of Coupling the Secondary Coil to the Primary is Shown Above.

ARRANGEMENT OF THE SET

In Fig. 3 is shown the arrangement of the panel; this may be made of wood or of bakelite—bakelite making a neater and better insulated panel. At the left is the dial controlling the vario-coupler, while at the right is the dial for the variable condenser. There are two switches between the dials, the upper one is for the coupler and the lower one for the loading coil. Fig. 4 shows the arrangement of the back of the panel, the way in which the set is laid out. Since every builder will use parts different in size, no dimensions are given for the panel or cabinet. This may be worked out easily.

OPERATION OF THE SET

The next and very important point to consider is that of operating the set. A good receiver is worth little to its owner if he knows nothing about operating it. The kind of tubes (or bulbs or audions or detectors) to use with this set are the soft tubes, such as the double filament Audiotrons, the Radiotrons, and Moorhead Electron Relay tubes. The writer has used all of the makes named and has found that the last named tube is the best, but it has a very critical adjustment. The Radiotron, while not bringing in distant signals as well, is easier to operate. When working a set, always adjust the plate voltage and filament rheostat carefully until the set oscillates; this is indicated when a click is heard in the phones. The oscillating of the set described in this article is controlled by the dials of the coupler and of the variable condenser. Also, the operator will find that the coupler has a great effect on the strength of the received signals.

The writer can guarantee success if the foregoing specifications are followed with some degree of care. He has built three of these receivers for his friends and has given others the plans for it. On one tube 9EB of Colorado, 6EN of California, and hundreds of eights have been heard. If a two-step amplifier is added to this set, it will bring in music which can be heard at a great distance from the phones. The writer will be glad to answer any questions about this set.

The Universal Receiver

By JOHN R. MEAGHER

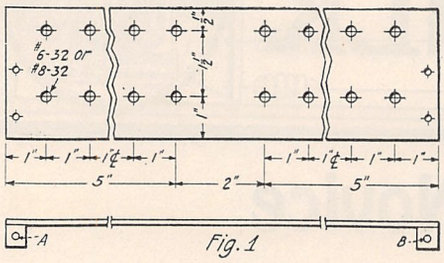


Fig. 1

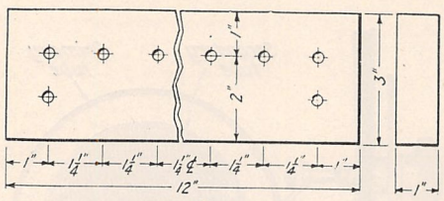


Fig. 2

Fig. 1 Shows the Layout of the Special Sub-Terminal Panel Incorporated in This Receiver. Details of the Honeycomb Coil Rack Appear in the Second Figure.

THE following description is intended for the advanced novice and amateur who desires to build a receiver which will incorporate the good features of the best types of sets and, at the same time, be easy to construct and low in cost. Even after the thrill of receiving distant broadcasting has somewhat diminished, this set will provide entertainment from the great number of amateur phone stations which may be picked up; it is very efficient on 200 meters. Additionally, it is possible to receive foreign high-powered stations, which is surely just as interesting as receiving a concert. By building and operating this set a great deal will be learned about reception and, though starting as a broadcasting fan, the constructor will probably end up as an accomplished radio bug.

THE TERMINAL SUB PANEL

Often the owner of a "cabinet" receiver wishes to try out a new improvement in the circuit, but, after taking a look at the interior wiring, he generally leaves it as is, for it would not be an easy task. In this set, however, provision is made for a sub panel inside the set at the top, on which are mounted the terminals of each instrument. By centering the terminals in this manner it is possible to wire up almost any circuit. The hook-up best adapted for a certain tube or special exterior conditions can be readily found. The sub panel in no way detracts from the appearance of the receiver. It is a much neater method than spreading the instruments all over the table and will give just as good results.

THE MATERIAL NECESSARY

One main panel, size 14"x12"x3/16".
One sub panel, size 12"x3"x1/8".
Two forty-three plate variable condensers.
One twenty-three plate variable condenser.
One rheostat and vacuum tube socket.
One single-gang filament switch.
One three-coil mounting.

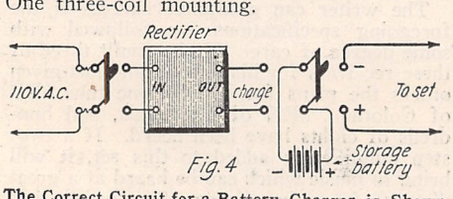


Fig. 4

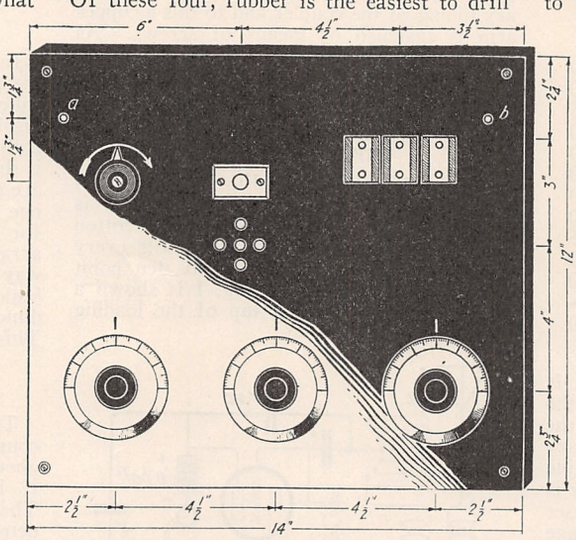
The Correct Circuit for a Battery Charger is Shown Here. This Wiring Method Prevents Possible Damage to the Receiver.

Wire, forms and plugs for short wave coils. Dials, tinfoil, wire, cambric tubing, etc.

When buying the condensers see that they meet these specifications. The plates must be rugged with fairly wide spacing. Shaft ends must be solid so that continual wear will not affect them. Most important, either the movable plates must have a flexible wire connection or the spring connection must be very good so that constant contact is assured. The socket recommended for this set is a Paragon for panel mounting. About seven makes of three coil mountings have been advertised in RADIO NEWS but the mountings which have the small knobs on top for adjusting the coupling are not suited for this set. The Remler or Cotocoil will serve. These mountings have an extension handle and when the hand is removed the detuning experienced with other mountings is minimized. Besides, the knobs on the usual type of mountings are very hard to adjust because they are in an awkward position. With the Remler or Cotocoil, the wrist can be at rest on the table while tuning. If the reader has a de Forest or similar type, I would advise purchasing two Remler extension handles and fitting them on the two outside movable plugs.

THE PANEL

Fig. 1. is a detailed plan of the main and sub panels. Either condensite celeron, bakelite XX, hard rubber or fibre may be used. Of these four, rubber is the easiest to drill but bakelite is much sturdier and can be given a nicer finish. The main panel is three-sixteenths of an inch thick, while the sub panel is only one-eighth inch.



FRONT VIEW OF THE UNIVERSAL RECEIVER SHOWING THE DISPOSITION OF CONTROLS AND GENERAL PANEL LAYOUT.

As the placing of the supporting screw holes in different types of condensers varies, only the shaft holes are shown in Fig. 1. It will be necessary to lay out the extra holes to fit after the variable condensers have been purchased. This also holds true for the coil mounting. The first step in the actual construction after buying the material is to drill the holes. These should be drilled carefully or a few panels may be spoiled in the attempt.

The position of the holes should be laid off directly on the face of the panels. Obtain the exact location and with a soft, sharp pointed lead pencil mark the points to be drilled. Place a center punch or sharp nail on these spots and tap hard enough to make a distinct indentation. Now proceed with the drilling, using the dents as a guide. It will be necessary to have three sizes of drills. One large size to cut half-inch holes for the condenser shafts, one to pass eight thirty-second screws and the other to pass six thirty-second screws. When drilling, secure the panels firmly to the work table, so that both hands are free.

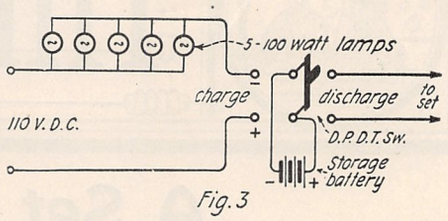


Fig. 3

If Direct Current is Available, the Diagram Above May Be Employed to Charge the Radio Storage Battery. The Charging Rate Depends Upon Total Lamp Wattage in the Circuit and May Be Regulated by Adding or Removing Lamps.

The indicating scratch marks are made by a vertical line from each shaft hole and on this is marked off a sector starting at a point one and one-quarter inches above the hole to a point two inches above the hole. This three-quarter inch sector is to be scratched out and later filled in with white lead. When scratching, go lightly at first and then press harder until the scratch is deep, solid and clean cut. A hard, sharp pointed instrument will be necessary. This mark is for three-inch dials as these should be used. Four-inch dials will look out of place on a panel of this size.

It will now be necessary to finish off and polish the panel. A very simple method is to get a handful of steel wool, spread a few drops of olive oil on the panel, and rub steadily until all trace of scratches vanish. Use plenty of oil and rub in the same direction always. The finished results will be surprising. To retain this clean and neat appearance the panel will only require to be cleaned regularly with an oily rag. The main panel need be polished on one side only as the rear is shielded. The sub panel should be polished top and bottom.

White lead should then be rubbed into the scratches or indicating marks. Use only a small amount of it and rub off the excess with a clean, dry rag. After it has dried over night rub again with an oily rag, to remove the thin white coating about the mark.

SHIELDING

Shielding is next in order. If the main panel is not shielded the body capacity effects will prove very annoying. By lining the rear of the panel with tinfoil or other metal sheet and connecting it to the ground, moving the hands away from or near to the set will not change the signal. In some sets

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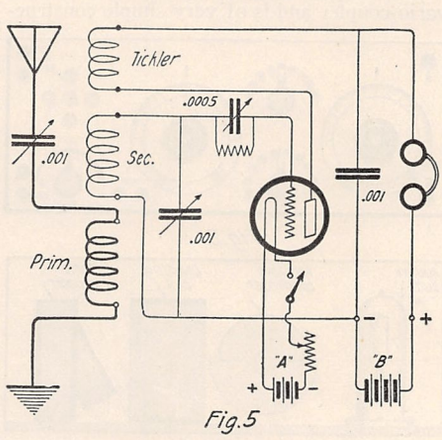


Fig. 5

Standard Three-Coil Regenerative Circuit: This is One of Many Hook-Ups Which May Be Used with the Receiver Described in the Accompanying Article.

Awards of the $50 Radio Wrinkle Contest

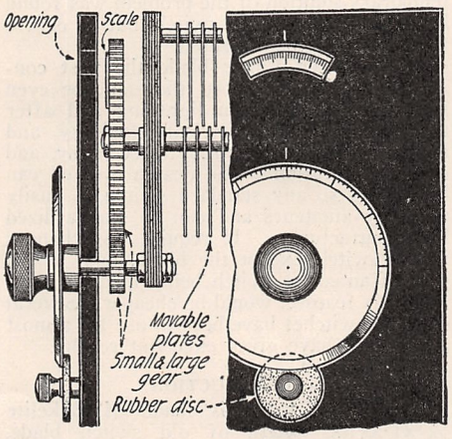
First Prize

A DOUBLE VERNIER

By LEO COHEN

WHILE tuning in phone signals and C. W., I experienced considerable trouble in adjusting the secondary condenser. The following is a method I devised and have used for some time with good results.

Taking an ordinary 43-plate condenser out of its casing I mounted a large gear wheel on its shaft; the condenser in turn was mounted on the back of the receiving panel in the usual manner with the exception that no shaft protruded. A small gear wheel was mounted on a brass shaft and fitted through the panel so as to mesh with the large gear. This shaft may be centered on the cover of the condenser or other arrangements made for its rear bearing, the panel acting as front bearing. Upon this shaft a 3-inch dial and knob was attached. At the present stage it may be used and an adjustment of 5 to 1 secured. The gears were obtained from a telephone bell ringer, which served the purpose admirably owing to the numerous teeth on the gears.



This Prize-Winning Suggestion for a Double Vernier Control is Very Practicable and Well Described.

For much finer adjustment, I fitted another shaft in vertical line with the condenser and dial centers, upon which was mounted a piece of rubber packing in such a manner as to bear friction against the under side of the dial. A small binding post knob was attached to this shaft which further allowed close adjustment, similar to the vernier attachments on the market today. You realize that the dial will turn several times before the condenser has made half a revolution and in order to know how your condenser is setting, a 180-degree scale is mounted on the large cog wheel and an opening cut in the panel to view the scale.

An illustration is herewith attached to make this description clearer and from the general plan the amateur may devise his own means for mounting the gears and condensers he may have on hand.

Second Prize

DETECTOR STAND OF NOVEL DESIGN

By R. E. GERHARDT

I present, in this article, an interesting wrinkle which has proved so satisfactory in actual use that I have decided to enter it in the contest.

Essentially designed for galena or silicon, this stand provides close regulation of the degree of pressure on the crystal. The importance of this feature is not to be overlooked if maximum efficiency is desired.

PRIZE WINNERS

First Prize, $25

Mr. Leo Cohen
310 West 14th Street
New York

Second Prize, $15

Mr. R. E. Gerhardt
Hoquiam, Washington

Third Prize, $10

Mr. W. S. Mayers
234 Watson Avenue
Fairmont, W. Va.

When completed, the stand is placed on a solid base out of the way so that when once adjusted, movement of the receiver or accidental jars will not affect the adjustment. It would be well, in building a crystal receiver, to keep this point in mind.

As may be seen in the diagram, a compass or divider is used as the movable arm and pressure regulator. Secure a good compass; cut off one leg at the point indicated and bore two holes for the insertion of the pivot-contact. The arm may be cut off with a good hack-saw or sharp file and should be rounded off to avoid accidentally scratching oneself. The holes are to be cut with sufficient diameter to pass an 8/32 round-headed nickel machine screw. For a crystal cup I have used an old battery carbon terminal, although a purchased cup will not cost much and presents a neater appearance. If desired, the holder may be made after the builder's own ideas. A clip is sometimes employed with good results.

$50 in Prizes

The special prize contest for radio amateurs and beginners is held each month. There are three monthly prizes as follows:

First Prize	$25.00 in gold
Second Prize	$15.00 in gold
Third Prize	$10.00 in gold
Total	$50.00 in gold

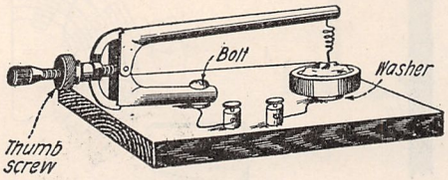
What we desire are simple ideas exclusively for the beginner and the novice, the simpler the radio idea the better the chance to win the prize.

There are lots of valuable little stunts that you amateurs run across every month, and we mean to publish these for the benefit of the entire Radio fraternity.

If possible, a clear photograph should be sent with the idea, but if that is not possible, a good sketch will do.

This prize contest is open to everyone. All prizes will be paid upon publication. If two contestants submit the same idea, both will receive the same prize. Address all manuscripts, photos and models to *Editor Radio Wrinkle Contest,* care of this publication.

As the size of the compass will vary from that which I am using, the exact distance between the swivel and cup cannot be given;



An Excellent and Exceedingly Simple Crystal Detector. Easy and Universal Control is Afforded.

however, the correct space is easily ascertained and should be marked on the base for drilling. Hardwood, fibre, bakelite, rubber or other good insulating material may be used for the base, the size of which will depend upon the type of compass employed. Secure a heavy piece and after the stand is assembled, it would be well to glue a thick layer of soft felt to the under surface. The felt will serve the dual purpose of preventing harm to polished tables and will allow the absorption of slight shocks and jars. I have used a piece of old storage battery jar for the base and after shining it up, was very pleased with it.

To assemble the instrument, it is necessary to drill two holes at one end for binding posts and two holes for the detector cup and adjusting arm. Use a good grade of well-insulated wire for connections and be sure that all points are soldered. For the cat-whisker, a No. 28 bare copper wire will give as good results as any. In actual use, the end of the wire touching the mineral should always be clean.

It is not necessary, contrary to our newspaper radio editor's opinion, to wash the crystal every week or so, or to wash it every day as advised by some. The daily tub in no way adds to the efficiency of the detector, as a trial will conclusively prove. If the dust is blown from the mineral surface every day, the unit will function satisfactorily.

If it appears as though the sensitivity of the mineral has faded, a new surface may be scratched with a knife. Either unmounted or mounted crystals give satisfaction with this stand. In general, keep the mineral as small as possible to allow only a short separation between the point of cat-whisker contact and the holder. This is said after the fact has been learned that most large crystals are "sensitive" near the edge. The stationary contact should be made to cover as large a portion of the unused surfaces as possible.

I am confident that anyone constructing this stand will find it entirely satisfactory.

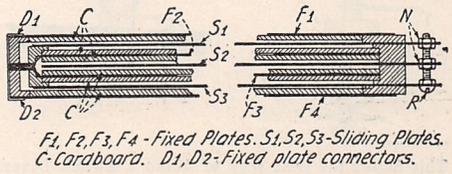
Third Prize

VARIABLE CONDENSER MADE FROM PHOTO PLATE HOLDER

By W. S. MAYERS

An old 5"x7" photographic dry plate holder, which has been discarded in favor of the newer film holder, may be used in the

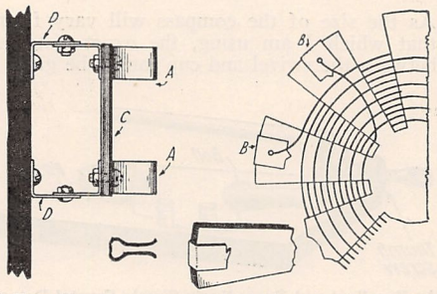
(*Continued on page* 794)



F1, F2, F3, F4 - Fixed Plates. S1, S2, S3-Sliding Plates. C-Cardboard. D1, D2-Fixed plate connectors.

A Good Idea. Use an Old Photographic Plate Holder as a Variable Condenser.

Practical Hints for Amateur Constructors



A Very Simple and Convenient Manner of Mounting Honeycomb Coils is Shown Above.

MOUNTING FOR SPIDER-WEB COILS

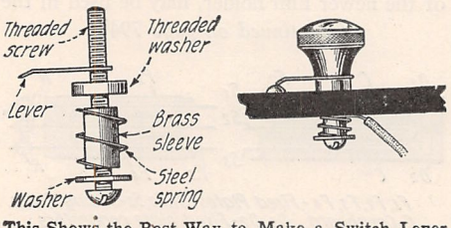
Spider-web coils are very easily constructed and because of their efficiency they have found favor in many amateur receiving sets. The difficulty in mounting these coils has presented a stumbling block to beginners and, I believe, has retarded their general adoption.

With this in mind, I have designed the simple mounting shown and described in this article. First obtain some fairly thin sheet brass, cutting it to size and shape as required. For a movable or coupling mounting, two right-angle brass strips are fastened to the panel as shown. They may be ½" wide, the length depending upon the personal wishes of the builder. Two more strips of almost the same size, except for the flanges which are set as shown to clasp the coil terminals, are cut and pivoted to the first angles. Use 6/32" machine screws and hexagon nuts for pivots and for clamping the angles to the panel. To each coil affix the small brass strips cut to the shape indicated, driving the pointed tips into the coil form securely. The strips are spaced the same distance as the clasps on the panel to permit contact. (The wire leads are soldered to their respective brass strip.)

A stationary coil mounting may be designed in the same manner so that, it it is ever desired, it, too, may be varied. Be certain that the clasps have sufficient spring to securely hold and make good electric contact with the coil terminal strips. It is not necessary to have the coils running in a certain direction as they may be inserted in the holder in either direction, an important feature.

Possibly a word concerning the spider-web coils themselves would not be out of place here. Use No. 24 D. C. C. throughout. This wire is good for all coils in receiving sets and manufacturers and amateurs would do well to standardize on it. The forms may be made from two or three circular discs of stiff manila board glued together under pressure. To the top and bottom, glue a strip of varnished cambric sheet or empire cloth. Nine or 11 radial slots are cut in the form and the wire carefully wound on till the desired inductance is obtained. A number of these coils, of varying turns, may be made and will prove satisfactory in the reception of different wave-lengths.

Contributed by S. Litchinsky,
Drumheller, Alta., Canada.

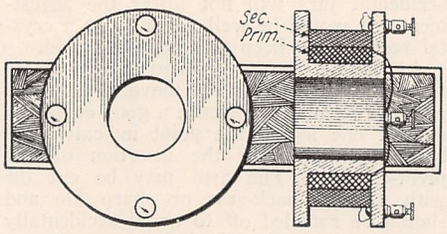


This Shows the Best Way to Make a Switch Lever for a Pocket Radio Set. The Knob is a Small Binding Post.

SWITCH FOR POCKET SETS

Many amateurs are beginning to make pocket sets, but they sometimes experience difficulty in the selection of a proper switch lever and become quite puzzled because of the fact that the ordinary switch is too big for the small space allotted to it. A suitable switch for such work can be made from a binding post. The style with the rubber knob and threaded washer is best. A piece of brass ½" high and 1/32" in thickness should be bent and made to fit the threaded screw and a steel spring which will fit loosely over the brass sleeve will have to be procured. It will be best to cut the lever out of a springy piece of brass. On tightening the washer, the switch will never become loose.

Contributed by J. Polak, N. Y. C.



A Ford Spark Coil Spool Can Be Used as the Winding Form of a Radio Frequency Transformer.

A RADIO FREQUENCY TRANSFORMER

I have found by experiment that the home-made radio frequency transformer is the only kind for the experimenter who wishes to build an efficient and selective radio frequency amplifier using from two to three or four stages of amplification.

Eight or ten such transformers as here described may be constructed in a short time at the work bench and will cover a large band of wave-lengths.

No. 40 cotton or silk covered wire may be used for both primary and secondary. Ford coil secondary wire may be used satisfactorily with ratio of primary and secondary windings 1-2, on short wave-lengths.

The winding forms are made from a Ford spark coil secondary spool, the wire first being removed and then the individual spools, used originally for winding the pies on the secondary, sawed out. They may be sandpapered and shellacked to improve appearance.

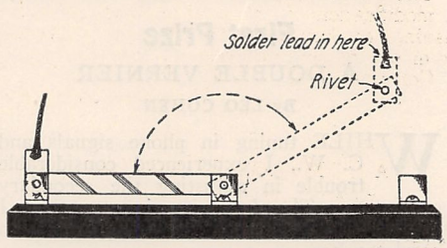
The primary is first wound on and the terminals fastened to binding posts, as shown in the drawing, this winding being covered with some insulating paper or cloth. The secondary is wound over this and the terminals fastened to the other pair of binding posts. The exposed secondary winding should be covered with paper or tape for protection.

Such transformers are easily constructed and serve well for amateur use.

Contributed by Cecil E. Rhode,
Eureka, Kansas.

A LIGHTNING SWITCH BLADE OF GREATER ELECTRICAL EFFICIENCY

In the design of radio installations, one of the simplest and best methods to increase efficiency in both transmission and reception is to eliminate, as nearly as possible,



This Type of Lightning Switch Prevents Any Loss in Poor or Dirty Contacts.

all unsoldered joints. In going over my own set to get rid of unnecessary joints I found one stumbling-block in the joints of the lightning switch. Since the switch was out of doors, these joints, because of the action of the weather, were of very high resistance and a test showed that the chief trouble was at the point where the blade was pivoted. The pivot to work freely had to be loose, allowing dirt and oxide to collect, while at the jaws the clipping action made a fairly good self-cleaning contact. It is remarkable that reception is not entirely blocked at times by the poor contact at the middle support. Such a joint is particularly harmful to C. W. transmission with its low potential. A temporary solution of the problem was found by dispensing with the switch, but of course this could not be tolerated.

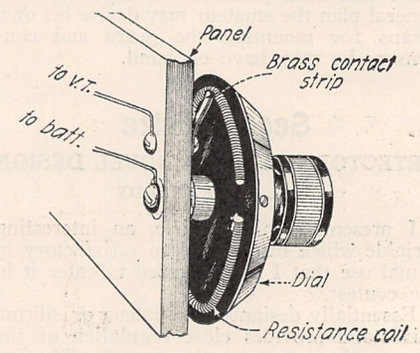
In designing a new blade the first consideration was to afford the same or even better protection from lightning and after that to increase electrical efficiency and maintain mechanical strength, economy, and ease of operation. The design evolved can be applied to any standard switch, is easily made by amateurs and can be standardized by manufacturers. It requires no changes in the switch except the blade, and, in the case of an entire switch being manufactured with this feature, would be cheaper. Several of these switches have been in use for almost a year and have given excellent results.

CONSTRUCTION

The blade proper is made of Bakelite ⅛"x1"x(the length of old switch blade, nearly always 6"). A strip of copper is needed 1/16"x1"x4⅛", bent as shown in the drawing, and drilled one half inch from the ends with a ⅛" drill or larger and countersunk. The Bakelite strip is also drilled to accommodate the pivot at one end and with the ⅛" drill at the other. All four corners should be rounded. The copper strip is then riveted to the Bakelite and the rivet filed off flush on each side. The copper must be allowed to turn freely. The lead-in is then soldered to the copper strip and the switch reassembled for use.

ACTION

The Bakelite forms an insulating handle for throwing the switch and also increases the insulation of the parts from the base. Only one unsoldered contact remains, and several sharp turns are eliminated, which



This Compact Rheostat Can Be Easily Made and Looks Well on the Set.

reduces brush discharge. As the copper strip swivels the lead-in is not kinked or twisted in any way.

The switch may be considered merely as a modification of the plug and jack system having an insulating handle, and a guide to direct the plug and keep it always at hand.

Contributed by E. P. TALBOT,
Indianapolis, Indiana.

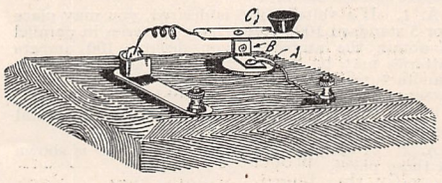
A COMPACT RHEOSTAT

The materials needed to make this rheostat are a composition dial, some resistance wire, a small strip of brass, and some screws and mica disc. Wind the resistance wire on a 3/16" rod; when the coil is wound on connect one end to the brass backing inside of the dial and cut the other end off about ¼" from the set-screw that runs from the top of the dial to the bushing. Cut out a round piece of thick mica large enough so that the wire will fit tightly on it, and then groove the mica. Cut out a hole in the center of the disc so it will fit snugly over the bushing, and drill a hole the size of this set-screw parallel with the disc. Put the set-screw in and this will hold the disc on the dial. Punch two holes in the disc where the two ends come and connect one end to the bushing. This serves as one contact and the other contact is made by the small brass strip that is fixed on the panel.

Contributed by LANDON CORRINGTON,
Memphis, Tennessee.

A UNIVERSAL CRYSTAL DETECTOR

I have not yet seen in RADIO NEWS a really good detector, from my point of view, that the beginner can construct easily from materials at hand in the workshop. My idea of a good detector is one with which

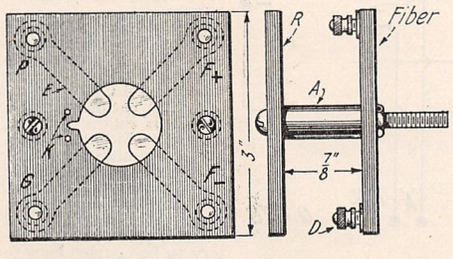


A Universal Joint Crystal Detector Which is Simple to Construct.

a fine adjustment may be made on any point of the crystal. The detector described here has a form of universal joint which allows such an adjustment.

It is mounted on a wood base, 6x3x¾". The materials required are, a base, two binding posts, a strip of spring brass 2½x ½", a wooden pot-lid knob, three small lock washers, and several pieces from a structural toy set such as "Erector" or "Meccano."

To make the universal joint first get a 2½" strip, three small angle pieces, and several nuts and bolts from the toy set. These are assembled as shown in the diagram with lock washers under the nuts at the points B and C. A round-head wood screw with a lock washer under the head is used to hold the joint to the base at A. A plain washer is placed between the wood and the angle piece to make it turn easily. The knob is put on one end of the horizontal arm and



A Tube Socket Can Be Made from Pieces of Scrap Bakelite.

the cat-whisker on the other. A wire is soldered near the middle of the arm and a pig-tail lead is made over to one binding post.

The screws at points A, B, and C should be adjusted to give the desired stiffness of operation.

The crystal holder is shaped from the strip of spring brass. This is bent hair-pin shaped as shown and an angle piece is soldered on one side. A wood screw is used to fasten it solidly to the base. This holder is connected to the other binding post. The holder should be made so that it closes all the way when the crystal is not in it.

If lock washers are not to be had, small stiff springs may be used in their place.

By careful workmanship this may be made a very neat and efficient instrument.

Contributed by JOHN W. DIXON.

A TEN CENT V. T. SOCKET

In the accompanying sketch I show a home-made V. T. socket which I have made for about ten cents.

Believing that a socket of this type will be of interest to many amateurs, the complete details are given here.

The socket consists essentially of two pieces of fibre (R) or other insulating material cut 3" square. In the center of each piece drill a 1⅜" hole. Drill four holes in the corners of the bottom piece and two extra holes for the supporting collar and screws.

From spring brass cut four springs as indicated (E). Secure the springs firmly to each corner of the bottom insulating strip, using binding posts, as shown (D). The two collars (A) are ⅞" long and may be cut from either solid stock or tubing.

Drill two holes in the upper spring and assemble the parts to form the completed unit.

The position of the slot for the tube pin should be carefully placed. Small studs (K) are driven into the upper strip on each side of the slot in order to prevent the tube from moving more than it should.

A row of these sockets may be made for an amplifier.

For the strips I have used the material on old storage battery jars with great success.

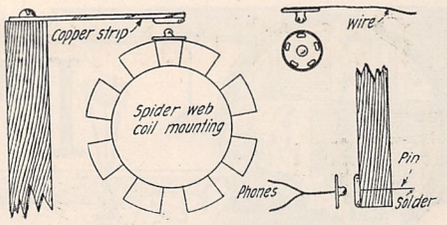
Contributed by EUGENE SCHMIDT,
Utica, N. Y.

SNAP FASTENERS AS CONNECTORS

The small snap fasteners for dresses that are sold in all ten cent stores for five cents a dozen may be put to a great many uses by the radio experimenter.

The accompanying sketches show a few of the uses to which they can be adapted. These fasteners make very neat binding posts and by using different sizes and different halves of the fastener the set can be made so that it is impossible to connect it up wrong. By soldering one half of the fastener on the phone cord and the other half on the panel with a common pin as shown, the phones may be plugged in quickly and if the cord gets a strong pull they will release and not pull the set off the table. A very good multi-point switch may be made by pinning to the panel as many points as wanted in a circle and also one at the center of the circle, and then with the two halves of the fastener soldered on to a strip of copper at a distance equal to the radius of the circle a switch arm can be made. The fastener in the center makes a good swivel and when the right point of the switch is found in tuning the other fastener can be pushed home making almost a positive contact.

Another use I have made of them is in mounting home-made honeycomb or spider web coils. I fasten one part of the fastener on both top and bottom of the coil form and

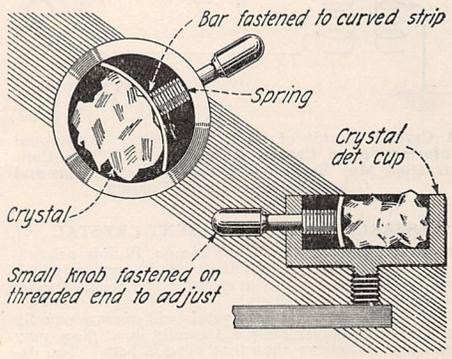


Snap Fasteners Are Very Useful as Connectors and in Many Other Ways.

solder the ends of the coil to them. The other half is soldered to a strip of copper or brass that acts as the arm to swing them on. This form of mounting is very handy if much changing of the coils is made for it works so quickly. A good connection to the end of the variocoupler or variometer rotor shaft may be made by soldering a fastener on the end and the other half to a flexible wire.

No doubt other uses will occur to the experimenter. They are certainly cheap enough and always make a good contact and provide a neat appearance.

Contributed by FRED. W. TEMPLE,
Lenwood Hospital, Augusta, Ga.



This Spring Clamp for a Detector Cup Permits Any Size of Crystal to be Firmly Held.

SPRING CLAMP FOR CRYSTAL

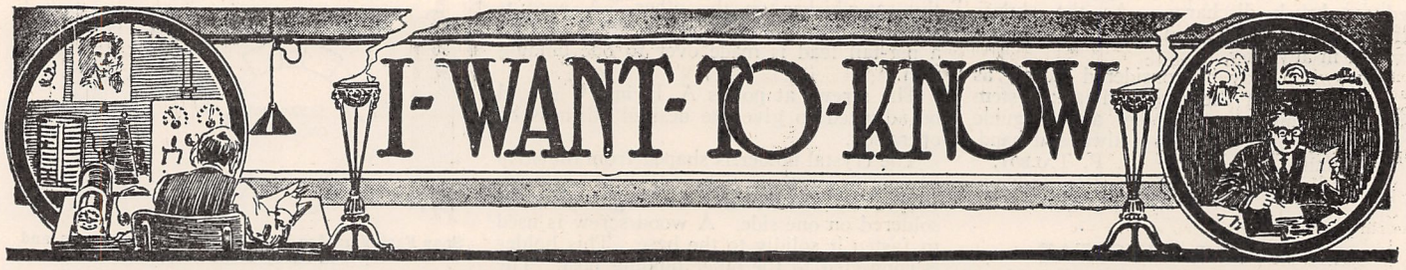
Here is a little idea that is very practical. It is a simple spring clamp to hold your crystal securely in its place. Anyone can make it from an old crystal cup and a narrow bar. The spring is an easy factor to obtain and the small knob can be found anywhere in the experimenter's "junk box." Solder a curved brass strip to the brass bar, which latter should fit your set screw hole, put a spring between the strip and the body of the cup on the bar so that when the latter is pulled out the spring contracts. Tap the end of the bar on the outside and screw a small hard rubber knob on it to adjust the clamp. Thus on pulling the knob out the clamp contracts the spring and the crystal, which is then set in the clamp, is freed, thus holding the crystal securely in place.

Contributed by JACK KAHN.
New York City.

MAKING HOLES IN GLASS PANELS

In making holes in glass, one often experiences difficulties through the chipping of the glass. A very simple way to overcome this is to procure some sand, wet it, and place about a teaspoonful on the spot where the hole is to be made. A lead pencil or any piece of round wood the size of the hole desired is then pressed in the sand, making a cast of the hole. Melt some lead or solder and pour into the impression, and the glass falling out leaves a fine hole. Glass will prove to be a serviceable panel and in the way described may be made cheaply.

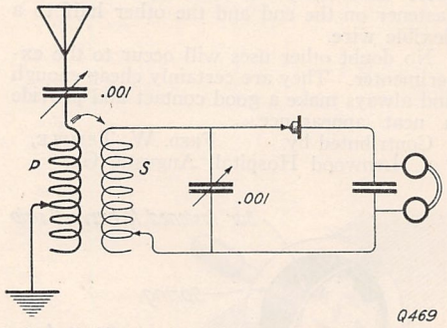
Contributed by EMMETT VANCE,
Oak Park, Ill.



THIS Department is conducted for the benefit of our Radio Experimenter. We shall be glad to answer here questions for the benefit of all, but we can only publish such matter of sufficient interest to all.

1. This Department cannot answer more than three questions for each correspondent.
2. Only one side of the sheet should be written upon; all matter should be typewritten or else written in ink. No attention paid to penciled matter.
3. Sketches, diagrams, etc., must be on separate sheets. This Department does not answer questions by mail free of charge.
4. Our Editors will be glad to answer any letter, at the rate of 25c for each question. If, however, questions entail considerable research work, intricate calculations, patent research, etc., a special charge will be made. Before we answer such questions, correspondents will be informed as to the price charge.

You will do the Editor a personal favor if you will make your letter as brief as possible.



A Crystal Circuit of High Selectivity. Additional Information on Crystal Receivers and Their Construction May Be Found in the Answer to This and Other Questions in the Column.

SEARCH FOR AN EFFICIENT CRYSTAL

(468) Mr. R. C. Crowe of Chicago, Illinois, asks:

Q. 1. I would greatly like to find a crystal which will give the best results in my set; is there any special one superior to all others?

A. 1. Many types of crystals will operate equally well, though occasionally a specially good piece may lead one to believe that that type is best. The design of the detector stand will greatly influence the results. Galena is the favorite but silicon will be found to be almost as good and retains a good spot for long periods at a time. A graphite contact instead of the usual copper cat-whisker will sometimes give surprising results when used in conjunction with galena. Carborundum has the advantage of eliminating fine adjustments and is very rugged. Molybdenite, zincite or zincite in combination with bornite, iron pyrites and others have been successfully used. A block of galena may be purchased and broken into small pieces. Some good crystals will most likely be found.

BEST CRYSTAL CIRCUIT

(469) Mr. R. Irvin of Salmon, Idaho, wishes to know:

Q. 1. Of all the crystal circuits which will give the most satisfactory results?

A. 1. The double circuit crystal receiver shown in this column will provide the most efficient method of crystal reception.

Q. 2. What form of inductances will be best and how should they be constructed if the range is to be from 200 to 600 meters?

A. 2. It is necessary to have two tapped inductances for which purpose tapped single layer coils, tapped honeycomb or duolateral coils, tapped spiderweb coils or other special forms will be suitable. A small and efficient loose coupler may be made by having a primary tube 3″ in diameter wound with 100 turns of No. 24 D.C.C. wire. Tap this coil at every 25th turn. The secondary may be wound on a 2½″ tube with 70 turns of No. 24 D.C.C.wire tapped every 15th turn. The coils may be coupled by sliding the secondary into the primary. If honeycomb coils are used, secure a DL 100 for the primary and tap it at each layer if possible; the secondary may be a DL 75 tapped at each layer. Spider-web coils of the same number of turns tapped every 25th for the primary and every 15th turn for the secondary may be used. Two variable condensers are connected as shown in the diagram. To vary the coupling of these coils, three methods are in common use. The secondary or primary can be secured to a sliding rod and moved to or away from the other coil. or one coil may be slid over the other; the third method, which is most used, is to have one coil on a hinge so that the coupling may be varied by charging the angle of windings. In all coils No. 24 D.C.C. may be used to good advantage.

Q. 3. Does it matter greatly in which direction you connect the crystal stand?

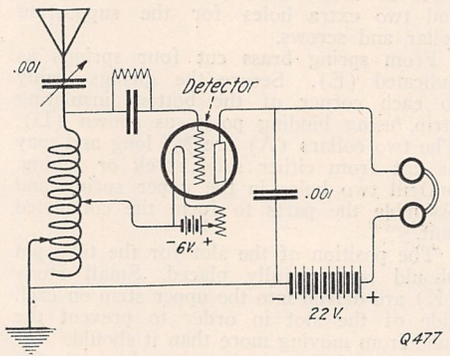
A. 3. No difference is noticeable in reversing connections to the crystal stand.

CIRCUIT OF MARCONI TYPE 106 RECEIVER

(470) Mr. R. E. Ciever of Chicago, Illinois, writes:

Q. 1. Please publish a hookup of the Marconi 106 tuner.

A. 1. The dia gram you request is shown on these pages.



There Is No Necessity for Throwing Away the Old Two-Slide Tuner. This Circuit Works Very Well When Properly Connected.

SELECTION OF APPARATUS

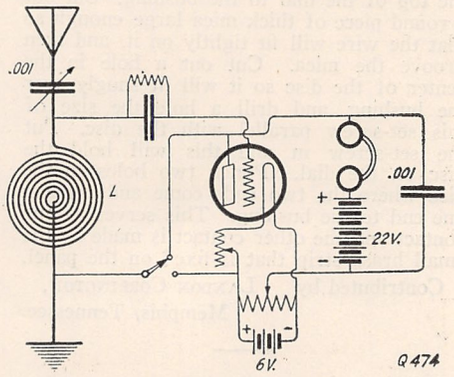
(471) Mr. W. O. Rondolf of Rochester, New York, writes as follows:

Q. 1. What transformers would you recommend for audio and radio frequency work?

A. 1. By reading the "Certificate of Merit" page in this and other issues of RADIO NEWS, you may be guided in the selection of efficient and high grade apparatus.

Q. 2. If jacks are used to plug in the tuner on any number of radio frequency amplifiers will the efficiency be greatly decreased?

A. 2. Unless the jacks have an exceptionally low capacity, the efficiency will be greatly impaired. A hookup is shown on these pages in which switches are used for this purpose. Remember to keep the leads as short as possible and the capacity at a minimum.



A Spiderweb Coil Is Employed in the Single, Audion. Ultraudion Circuit Shown Above.

450 AMPERE HOUR STORAGE BATTERY

(472) Mr. John Flynn of New York desired the following information:

Q. 1. Where may I obtain a fully-charged 450 ampere storage battery?

A. 1. If a voltage of 6 is desired, you may place 4 or 5 standard 100 ampere hour batteries in parallel to obtain the amperage you desire. 100 ampere batteries may be secured from any storage battery manufacturer. We do not know where a single battery of such large capacity may be obtained.

Q. 2. Please publish hookup of a Marconi crystal receiver.

A. 2. A diagram of a Marconi receiver is shown on these pages.

ARMSTRONG SUPER-REGENERATOR

(473) Mr. A. Woehr of Geneso, Illinois, writes:

Q. 1. In the Armstrong super-regenerative circuit is it necessary to change the size of the grid and plate inductances of the second tube when the other inductances are changed for different wavelengths?

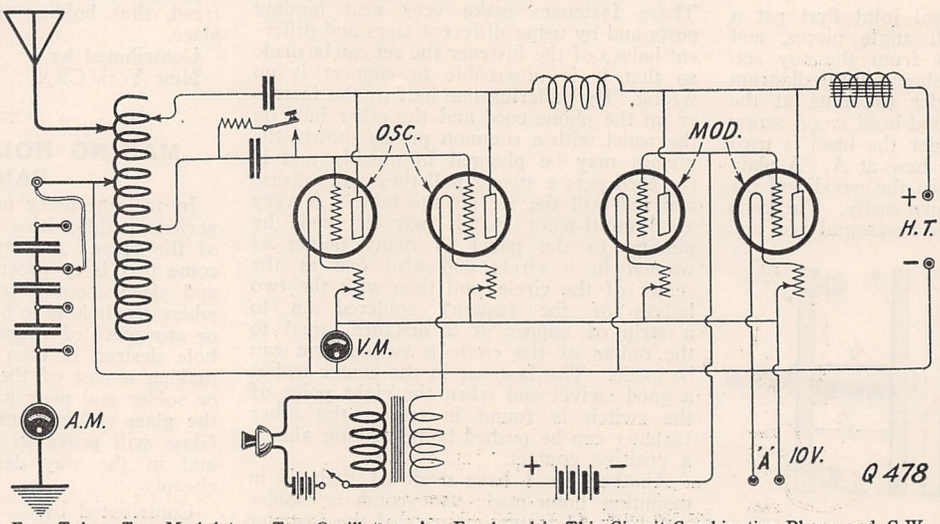
A. 1. The grid and plate coils of the second tube in the circuit employing two tubes remain constant. Only the tuning inductances of the first tube and the aerial inductance need be changed when the wavelength is to be varied.

Q. 2. Will two detector tubes give good results on this circuit?

A. 2. No, we would advise that you employ either hard amplifying bulbs or low power transmitting tubes.

Q. 3. What plate voltage may be used with the tubes?

A. 3. With small 5 watt transmitting tubes, 200 to 300 volts may be placed upon the plates. Use 80 to 100 volts on amplifier tubes.



Four Tubes, Two Modulators, Two Oscillators, Are Employed in This Circuit Combination Phone and C.W. Transmitter. When It Is Desired to Use I.C.W. a Buzzer May Be Placed in the Position the Microphone Is Connected.

SINGLE COIL V. T. RECEIVER

(474) Mr. G.T. Payson of Macon, Missouri, requests:

Q. 1. Please publish an efficient hookup for one spiderweb coil, one variable condenser and a vacuum tube control unit.

A. 1. The diagram you request is shown on these pages. Either straight audion or ultraudion connections may be used. If desired, another spiderweb coil may be connected in series with the plate and positive pole of the B battery to be coupled back to the main inductance for regeneration.

Q. 2. Will a potentio-

meter across the A battery be of any aid in reception?

A. 2. The A battery potentiometer will be of some benefit if properly adjusted. A tapped B battery could be used instead but the plate voltage control would not be as accurate. The potentiometer connections are shown in the diagram.

GROUNDING THE METALLIC RADIO MASTS

(475) Mr. H. J. Simpson of the Bronx, New York, writes:

Q. 1. Will there be any loss in efficiency if the metallic masts supporting an aerial are grounded?

A. 1. A small amount of absorption will result if the masts are grounded but we do not believe that the loss will be very great.

Q. 2. Why is it possible for the antenna voltage to reach a value higher than the secondary current?

A. 2. The step-up action of the oscillation transformer will explain this.

ANTENNA CONSTRUCTION

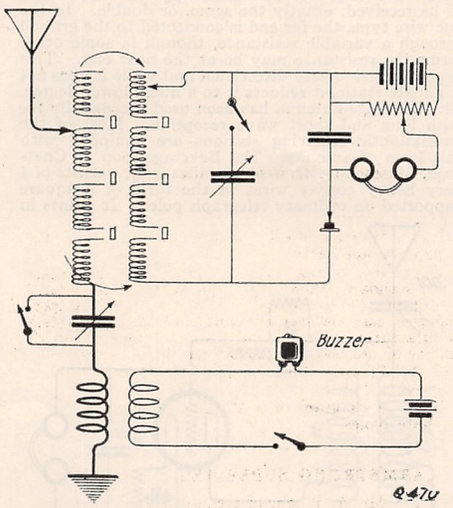
(476) Mr. H. Reynolds of San Francisco, California, requests:

Q. 1. In what direction shall I place my inverted L aerial so that I may obtain best results from all points in the United States?

A. 1. If your aerial lies in a line extending from east by north to west by south with the lead-in at the eastern end, you will obtain the desired effect. An inverted L aerial is directional in a direction opposite to that of the free end. For efficient all-round reception in the central United States, amateurs in that district should employ T aerials about 150′ long placed in an east and west direction. By applying the principle of the directional effect of different Types of aerials, anyone may arrange his aerial for either the best all-round reception or maximum signal strength from some particular station.

Q. 2. Is the insulation in the receiving aerial very important?

A. 2. The best possible insulation should be employed in any aerial if maximum results are desired.



The Hookup Employed in the Marconi Type 106 Tuner Is Shown Above. The Battery and Potentiometer Are Used in Conjunction with a Carborundum Detector.

DOUBLE SLIDE TUNING COIL

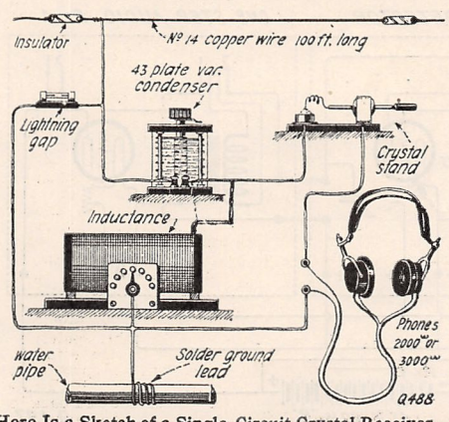
(477) Mr. Dill of Hazleton, Pa., asks:

Q. 1. Please show a diagram of a two-slide tuner and vacuum tube detector?

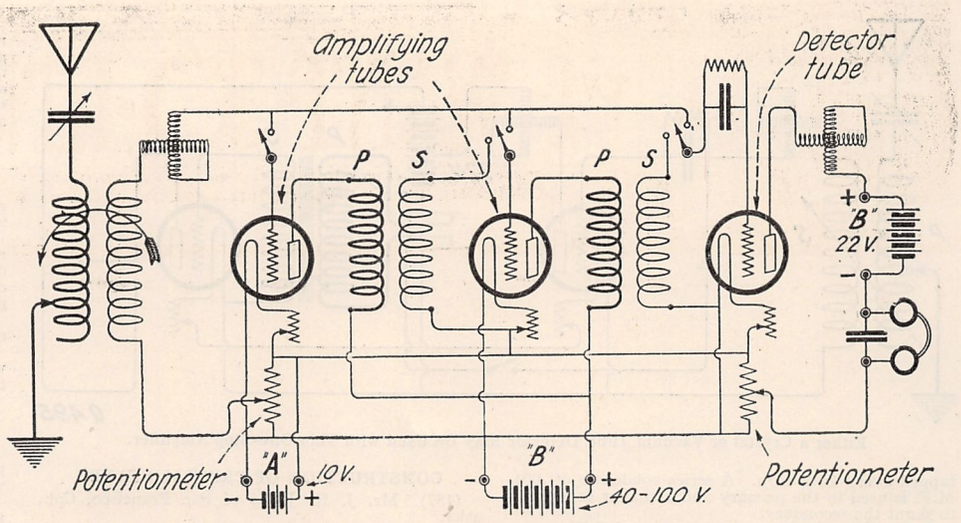
A. 1. The diagram you request is shown in these columns.

Q. 2. Please give all details.

A. 2. The constants are shown in the diagram. You will need a two slide tuner, a variable condenser, a grid condenser, a socket, a rheostat, a B battery, a detector tube, a headset, a fixed phone condenser, wire, etc. By carefully adjusting the slider it is possible to obtain very good results with this simple outfit. The slider connected to the negative side of the filament controls the regeneration, while the ground slider and aerial series condenser constitute the wavelength control.



Here Is a Sketch of a Single-Circuit Crystal Receiver, Data for Which Will Be Found in the Answers to Question 488.



Q. 471—A Switching Arrangement for a Radio Frequency Amplifier.

TRANSMITTING CIRCUIT

(478) Mr. E. J. Seyfried of Flushing, New York, wants to know:

Q. 1. Please publish a hookup for a C.W., I.C.W. and telephone transmitter using four 5-watt tubes.

A. 1. A suitable circuit is shown on these pages for the set you desire to employ.

Q. 2. Where may I obtain "peanut" tubes?

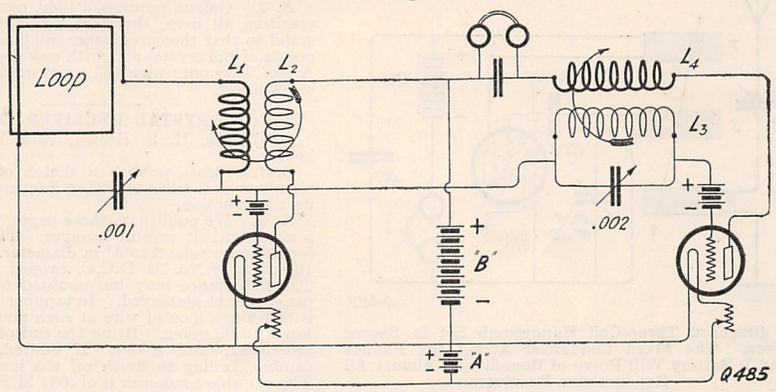
A. 2. "Peanut" tubes or Aerotron bulbs are manufactured by the Westinghouse Company, but are not on the market at the present time.

WAVEMETER FOR 150-250 METERS

(479) Mr. Jack Dempsey of New York, asks:

Q. 1. Please give me some constructional data on a short wave wavemeter.

A. 1. Wind a coil of 25 turns No. 18 D.C.C. wire on a well-seasoned and shellaced wooden form. Shunt this coil with a good make of 43 plate variable condenser; the condenser is the determining factor in the wavemeter and great care should be exercised in its purchase. Mount the coil and condenser in a box on a fiber panel; make connections direct (avoid all bends). The dial should be riveted or otherwise firmly attached to the shaft and should be set so that when zero is registered on the scales, the capacity is lowest. Write the Bureau of Standards for shipping instructions and if you follow them out carefully they will calibrate your wavemeter. The range of this meter will be rather large but use only the portion of the 180° scale between 20° and 160°. In this manner the curves at the maximum and minimum setting are avoided. In asking the Bureau to calibrate the meter, request that one point be taken at 200 meters so that there will be no discrepancy in the finished curve. If you desire a D.C. 25 honeycomb coil could be used instead of the inductance mentioned.



The Armstrong Super-Regenerative Receiver, When Properly Adjusted, Is Capable of Extreme Amplification.

AMPLIFIER TROUBLE

(480) Mr. T. Borden of New York wishes to know:

Q. 1. I have a one stage amplifier and am unable to secure proper operation; what would you advise?

A. 1. The general trouble with amplifiers may be traced to improper connections at the amplifying transformer. It would be advisable to reverse the primary connections to make sure they are properly connected. Try reversing the storage battery leads to the amplifier. Use a plate power up to 100 volts if regular amplifying tubes are used. It will be well to place a fixed condenser of .001 M.F. across the primary of the first transformer to pass the radio frequency currents in the plate circuit of your regenerative set.

Q. 2. What size honeycomb coils should I use for 1500 meters reception?

A. 2. DL 200 primary, DL 150 secondary, DL 75 or 100 for tickler.

CORRECT SIZE WIRE FOR RADIO WORK

(481) Mr. Kidd of New York inquires:

Q. 1. What size wire should be used in the different parts of a radio receiving set?

A. 1. No. 14 copper or copper-clad may be used for the aerial, ground and connections. No. 18 may also be used for the connections. No. 24 double cotton-covered can be used for coils and couplers. No. 16 is a safe size to carry the filament current although a heavier wire will be better when using more than one tube.

Q. 2. I have often seen the terms D.C.C., S.C.C., S.S.C., and at times, E.C.—what do they mean?

A. 2. D.C.C. means double cotton-covered; S.C.C. means single cotton-covered; S.S.C. means single silk-covered; E.C. means enamel covered.

Q. 3. What determines the size covering on wire to be used in making turning coils?

A. 3. If distributed capacity is to be kept low for efficiency in operation, D.C.C. is generally used. If small size is required, S.S.C. or E.C. may be used with a slight loss in efficiency.

STANDARD HONEYCOMB CIRCUIT

(482) Mr. N. Dow of Philadelphia, Pa., asks:

Q. 1. Please show a honeycomb hookup with V.T. detector.

A. 1. The diagram you request is published on this page.

Q. 2. Is such a circuit suitable for damped and undamped waves?

A. 2. This circuit will respond to all types of waves when properly tuned.

Q. 3. What will give best results as a receiving ground, the water pipe, gas pipe, radiator, fire escape or counterpoise?

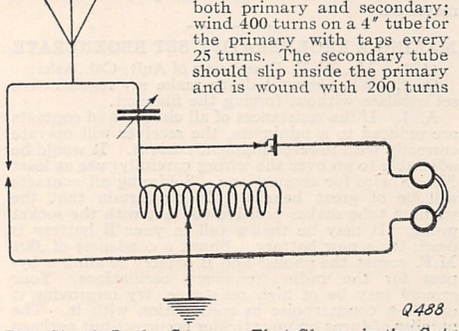
A. 3. The water pipe will generally prove more efficient then the other ground you mention, though a combination or two or more of the others will be satisfactory.

2500 METER LOOSE COUPLER

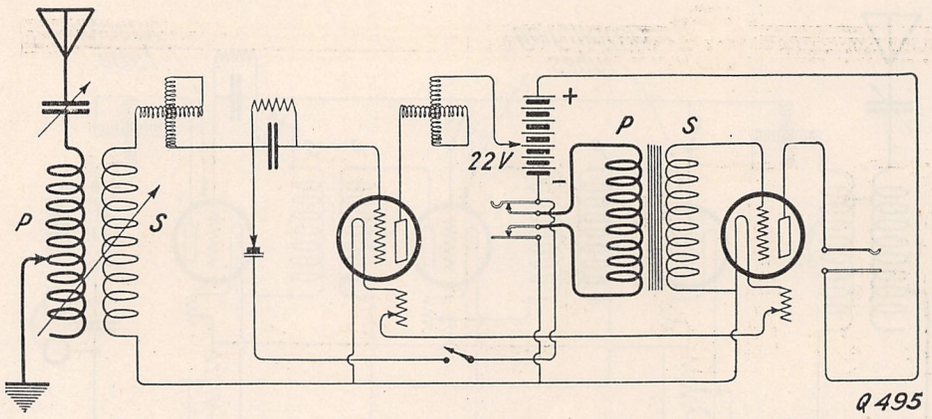
(483) Mr. Stephen Morton, Jr., of Elizabethton, Tenn., writes:

Q. 1. Please give me instructions for building a loose coupler to tune up to 2500 meters.

A. 1. Use No. 24 D.C.C. on both primary and secondary; wind 400 turns on a 4″ tube for the primary with taps every 25 turns. The secondary tube should slip inside the primary and is wound with 200 turns



This Circuit Is the Same as That Shown in the Cut on the Opposite Side of the Page. In This Diagram Symbols Are Used to Denote Each Instrument. As an Aid to Beginners the Other Cut Has a Sketch of Each Part.



Either a Crystal or Vacuum Tube Detector May Be Used with This One-Step Amplifier.

tapped every 25th turn. A series condenser of .001 M.F. is used in the primary and a similar condenser to shunt the secondary.

Q. 2. What is the average phone and C.W. range of a 5-watt transmitter?

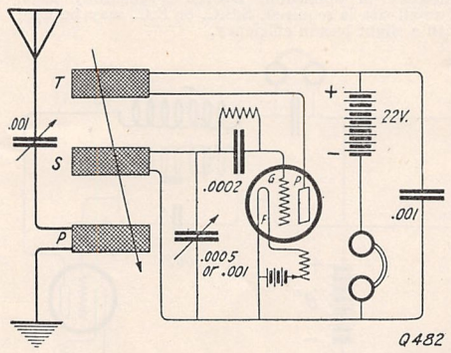
A. 2. With an efficient transmitter and a good receiving set, the phone range should be about 20 miles, the C.W. range about 50 miles.

CHOKE COILS FOR POWER AMPLIFIER

(484) Mr. N. Michel, Union Hill, New Jersey, asks:

Q. 1. How may I construct the choke coils for use in the power amplifier described on page 971 of the April-May issue of RADIO NEWS? Can I purchase them?

A. 1. A suitable choke coil may be purchased at



A Standard Three-Coil Honeycomb Set Is Shown Here. The Fixed Condenser Across the Phones and B Battery Will Prove of Benefit with Almost All Regenerative Receivers.

any electrical store as the primary of the small size of Wayne bell-ringing transformer is satisfactory for this purpose.

ARMSTRONG SUPER-REGENERATOR

(485) Mr. Jason Crain, Elnio Mayer, P. Rabito and others, ask:

Q. 1. Please publish a hookup of the new Armstrong Circuit employing two tubes.

A. 1. The hookup you request is published on these pages.

Q. 2. How many volts should be used on the plates?

A. 2. The plate voltage will depend upon the tubes employed. For amplifier tubes, 100 volts will be satisfactory. For transmitting tubes, use about 200-300 volts. Transmitting tubes have proven satisfactory with this circuit.

Q. 3. What value should the different coils have for 360 meter reception?

A. 3. The coil L1 is the primary of a variocoupler and L2 the secondary of the same, rewound with 90 turns; L3 is a 1,250 duolateral coil and L4 a 1,500 duolateral coil. The phone condenser should have a capacity of .005 M.F. Some difficulty may be found in tuning this circuit until the proper control is mastered.

MAKING A REGENERATIVE SET REGENERATE

(486) Mr. W. E. Dougherty of Ault, Col., asks:

Q. 1. What must I do to make my regenerative set oscillate without forcing the filament.

A. 1. If the resistances of all circuits and contacts are reduced to a minimum, the receiver will operate correctly with lowered filament current. It would be advisable to go over the wiring carefully; use at least No. 18 wire for connections. Soldering all contacts will be of great benefit. Make certain that the vacuum tube makes positive contact with the socket prong. It may be that a cell in your B battery is dead; try a new battery. Shunt a condenser of .001 M.F. across the phones and B battery to allow a by-pass for the radio frequency oscillations. Your ground may be of high resistance, try improving it or use a counterpoise in conjunction with it. The number of turns on your tickler is correct but perhaps closer coupling between tickler and secondary would help. Keep the secondary condenser as near zero as possible, using the inductance to increase the wavelength. Make a grid leak from the grid to the positive side of the filament.

CONSTRUCTION OF CRYSTAL STANDS

(487) Mr. J. R. Jones of San Francisco, Cal., asks:

Q. 1. Would you advise me to place my crystal stand directly upon the receiver panel or will I have better results by making it entirely separate?

A. 1. It would be advisable to construct the crystal stand independent of the tuner. The reason this is preferable is primarily due to the fact that when a small crystal set is tuned, the cat-whisker is apt to be jarred out of adjustment, necessitating another bothersome search for a sensitive spot. By placing the stand, or better still, two or more stands controlled by a switch, upon a firm base, connecting them correctly to the tuner and locating the best position for the cat-whisker, you may tune or move the receiver without fear of knocking out the light contact.

Q. 2. What are the requirements for a good galena stand?

A. 2. Galena requires a light contact and is not sensitive all over, therefore you should design the stand so that the cat-whisker will be able to touch all points of the crystal and with any degree of pressure. A No. 28 copper wire will prove satisfactory for the cat-whisker.

CRYSTAL RECEIVER DATA

(488) Mr. H. S. Brown, New York, wishes to know:

Q. 1. Please publish a sketch of a good single circuit crystal receiver giving information relative to its construction.

A. 1. We publish on these pages, two diagrams of a single circuit crystal receiver. The inductance is formed on a tube 3 to 4" in diameter. It consists of 100 turns of No. 24 D.C.C. tapped every 10 turns. The inductance may be mounted on a board or a panel may be employed. In tapping, the best method is to leave a loop of wire at each point from which a tap is to be taken. Bring the end of the loop to the switch tap and solder. If desired, you may use cambric tubing to finish off the instrument neatly. The variable condenser is of .001 M.F. Connections between instruments may be made with No. 18 copper wire. Connect the lightning arrester as shown. Information on crystal stands and other simple apparatus will be found elsewhere in this column.

RECEIVER RANGE

(489) Mr. W. J. Pormba of Chicago, Illinois, wishes to know:

Q. 1. What is the range of a regenerative receiver, employing two variometers and a variocoupler?

A. 1. It is very difficult to state the distance over which a receiving set will function. Under favorable condition with a good set carefully tuned it is possible to hear phone stations of high power up to one or even two thousand miles. This, however, could not be accomplished every day. The average range is about 200 miles lower in summer and generally greater in winter. The time of day, the skill of the operator, the power and efficiency of the transmitter will all determine the distance which may be covered.

Q. 2. In what manner does audio frequency differ from radio frequency?

A. 2. Audio frequency is audible to the ear while radio frequency is inaudible. Frequencies below 10,000 are usually called audio, above 10,000 they are radio frequencies. Some ears can respond to vibrations above 10,000 but the average person cannot hear such sounds. For that reason the distinction is drawn at a frequency of 10,000 cycles per second.

AMPLIFYING V. T. AS DETECTOR

(490) Mr. H. Smith of Springfield, Mass., writes:

Q. 1. Which type of bulb would you advise me to use with the set described on page 1214 of the June issue of RADIO NEWS?

A. 1. Mr. H. S. Pyle, the writer of the article you mention, recommends a hard or amplifying tube as it does away with critical filament control. You may employ either a hard or soft (detector) tube with good results.

Q. 2. With a loop aerial should I be able to receive stations ten mile away with this set?

A. 2. It would be possible to cover such a range with a loop, but the set Mr. Pyle described will function much better with the regular aerial and ground.

PHONE POLARITY

(491) Mr. J. Young, Honolulu, writes:

Q. 1. Is it necessary to have the polarity of the phones correct when using a plug and jacks in a vacuum tube set?

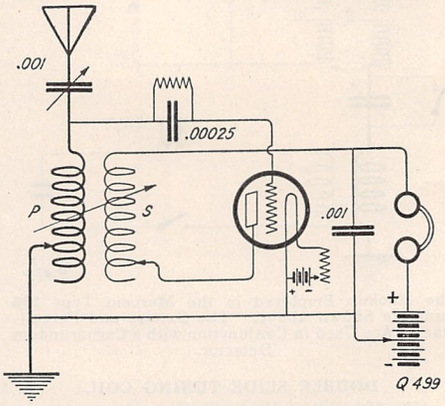
A. 1. It is not absolutely necessary to have the polarity correct but most phones work best when connected in the proper direction. One manufacturer gives the correct polarity with each headset, a procedure others would do well to copy. Information on the correct polarity of phones when used in vacuum tube sets has appeared in previous copies of RADIO NEWS.

BEVERAGE ANTENNA

(492) Mr. J. Thomas of Tiffin, Ohio, wishes to know:

Q. 1. What is "Beverage" antenna?

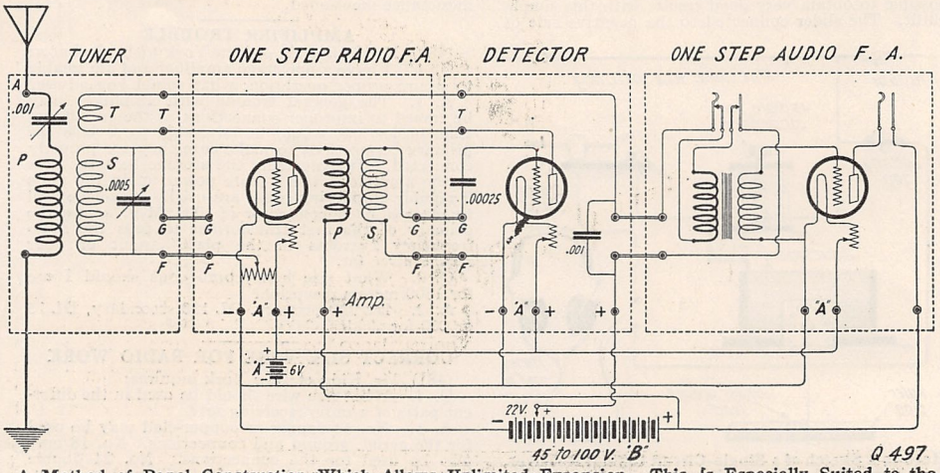
A. 1. This form of antenna is named after its originator and essentially consists of one or more wires relatively low and either ½ the wavelength to be received, exactly the same, or double. In the one wire type, the far end is connected to the ground through a variable resistance, though in some other forms the resistance may be at the near end. This type of aerial is very directional and while it does not eliminate static, it reduces it to a much lower degree. The Beverage antenna has been used successfully for both long and short wave reception. Most of the transatlantic receiving stations are equipped with this form of antenna. The Beverage loop at Chatham, Massachusetts, is seven miles long, consists of 4 very heavy copper wires in the form of a square supported on ordinary telegraph poles. It points in



A Loose Coupler Provides a Good Tuning Element for a Single-Circuit Receiver, if the Above Circuit Is Employed.

a west by south direction with the lead-in at the eastern end. Reception from POZ and OUI in Germany and LCM in Norway is extremely successful while NPL in California which formerly had caused heavy interference, is barely heard. Mr. Godley

(*Continued on page* 778)



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Remler No. 502 Panel-mounted Variometer	9.75
Remler No. 500 Moulded Variometer	6.50
Remler No. 501 Same with No. 100 Knob and Dial	7.50
Remler No. 503 Variocoupler	5.40
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Clapp-Eastham F-735 43-Plate Var. Condenser	4.75
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Radio Equipment at KDKA

(*Continued from page 616*)

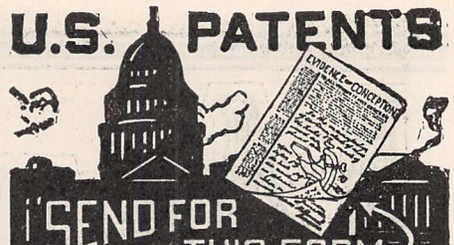
which, in conjunction with the condensers and oscillation transformer, change the 2,000 volt direct-current power into alternating-current power at 833,000 cycles, thus generating the carrier wave, which is impressed on the antenna through a remote controlled double throw switch, which allows the same antenna to be used for receiving when the station is not broadcasting. The amplitude of the radio frequency wave thus generated is constant as long as the plate voltage remains constant, and fluctuates with the plate voltage when the latter is varied.

The function of the five modulator tubes, also rated at 250 watts each, is to vary the voltage on the plates of the oscillator tubes according to the voice frequency impressed upon their grids by the speech amplifiers. This system is known as power modulation, the modulation being accomplished by means of the constant choke coil in series with the positive lead to the modulator and oscillator tube plates. The grids of the modulator tube are held at a static potential of 80 volts negative with respect to their filaments by means of a battery. The audio frequency from the speech amplifier then adds to or subtracts from this 80 volt grid potential. At an instant when the modulator tube grids have impressed upon them by the amplifiers a low negative, or zero potential with respect to their filaments, the tube impedances from the plate to the filament are low and a large plate current flows in the 2,000 volt direct-current circuit to the modulator tube plates. Because of the very large inductance (50 henries) of the audio frequency choke coils in series with the plate supply, the total generator current can change very little in a brief interval of time. Hence, part of the generator voltage occurs across the choke coils, thus lowering the voltage impressed on the oscillator tube plates and hence the radio frequency output of the set. The next instant when the modulator tube grids have a high negative potential with respect to their filaments, the plate impedances are high and little or no current flows through the modulator tubes. The choke coils, tending always to keep the total generator current constant, create a voltage which adds to the generator voltage and thus forces most of the current into the oscillator tubes, which increases the radio frequency or antenna output accordingly. In this way the audio frequency choke coils cause the voltage applied to the oscillator tube plates to fluctuate in proportion to the speech voltage impressed on the grids of the modulator tubes by the speech amplifier. As the amplitude of current in the antenna varies directly with the plate voltage on the oscillator tubes and as this voltage varies from nearly zero to 4,000 volts, the antenna current varies accordingly. Fig. 4 shows an oscillogram of rectified antenna current taken when the announcer is speaking loudly into the pick-up transmitter. It is seen that the antenna current varies from nearly zero to nearly twice its no talk value. This variation in antenna current at voice frequency is known as modulation.

The radio frequency choke coils in series with the oscillator tube plates serve to stop any radio frequency from entering the modulator and power supply circuits. These choke coils are of air core construction and are about five millihenries inductance each. They thus offer a high impedance to the radio frequency, but negligible impedance to the audio frequency.

In order to indicate the amount of modulation, a so-called modulation meter has been developed. This consists of a current trans-

U.S. PATENTS



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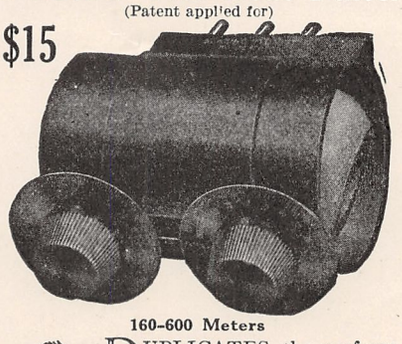
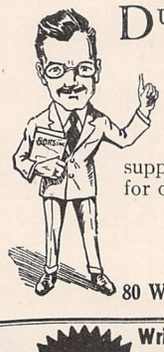


160-600 Meters



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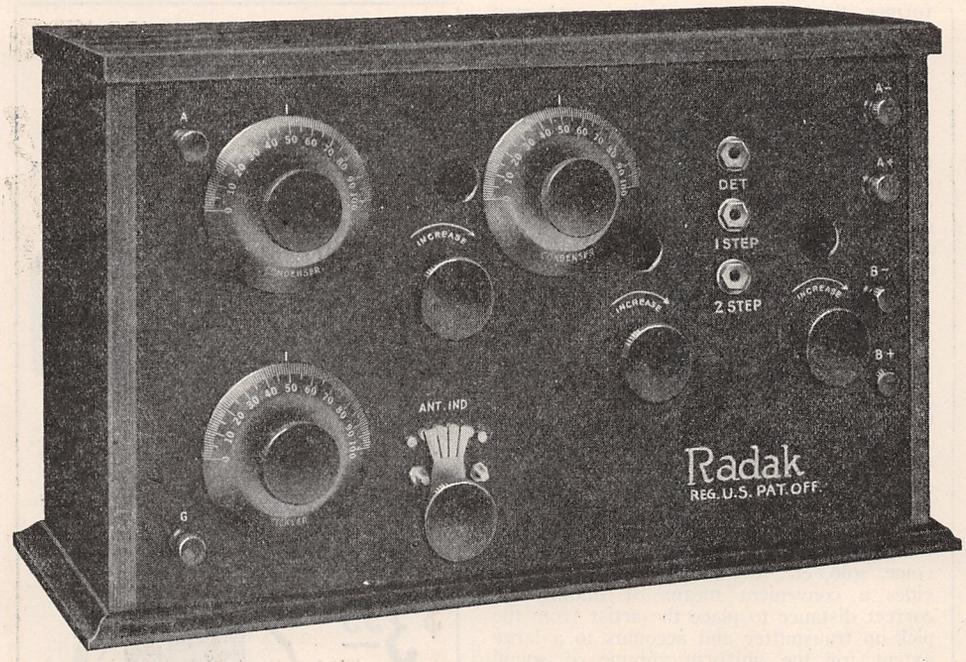

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SPECIFICATIONS

MODEL R Z RADAK

Cabinet: Solid mahogany, dull finish. Hinged cover. Compartment for B battery.

Panel: Condensite, dull finish black; white lettering.

Dials: Indestructible metal, black with white lettering.

Binding Posts: Hard rubber composition.

Condensers: Balanced type, built as a Vernier; two rotary, three stationary plates.

Antenna Inductance: Wound on formica tube.

Plate Inductance: Wound on molded ball.

Switch: Fan blade.

Rheostat: Clapp-Eastham type H-400.

Circuit: Single circuit regenerative.

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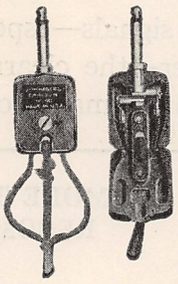

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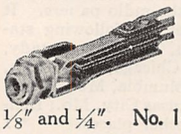

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former, the primary of which is connected in series with the direct-current supply to the oscillator tube plates and the secondary of which is connected to a thermo-ammeter. The transformer ratio is such that an audio frequency variation in the direct-current from zero to twice its normal value gives full scale deflection. An air-gap is provided in the transformer core to prevent saturation due to the direct-current component of the plate current. The meter has a current scale marked from 0 to 100 per cent modulation. When the announcer is speaking into the transmitter, the modulation meter averages about 40 per cent with maximum between 70 and 80 per cent. Piano solos average about 30 per cent, violin solos 20 to 30 per cent and vocal numbers 40 to 50 per cent with maximum of 100 per cent. Of course the modulation meter indicates only the average volume of sound. While the meter may read only 30 per cent in case of piano music, the individual notes at the instant of striking may reach 80 to 90 per cent. Allowing for the kind of sound being transmitted, that is, piano, speaking voice, solo, etc., the modulation meter provides a convenient means of finding the correct distance to place the artist from the pick-up transmitter and accounts to a large extent for the uniform volume of sound received from KDKA. The instruments at the top of the transmitter panel, Fig. 2, are from left to right, filament voltmeter, ground current meter, plate ammeter, modulation meter and plate voltmeter. The antenna current meter is mounted on the wall with a series condenser and discharge resistance and is not shown in the photograph.

The antenna at KDKA consists of six wires, 190 feet in length on 20 foot spreaders. This antenna is supported 210 feet above the ground by a brick smoke stack at one end and by a 100 foot pipe mast on a nine-story building at the other end. The operating room and studio are located on the ninth floor of this building. Fig. 5 shows the mast end of the antenna with the operating room directly below. A counterpoise which is a duplicate of the antenna in construction is placed 110 feet beneath the antenna. This brings the counterpoise about 15 feet below the transmitting set. The down lead from the antenna and the counterpoise lead are made up of eight strands of No. 14 copper wire equally placed around 1.5 in. diameter wooden spacers. The natural period of this aerial system is approximately 412 meters. A series condenser of 0.0005 mf. capacity is used in series with the antenna and sufficient loading inductance added to obtain the desired wave length of 360 meters. The series condenser is shunted by a radio frequency choke coil of 10 millihenries inductance in series with a one megohm resistance, to drain off any static charge that might accumulate on the antenna when insulated from ground by the series condenser. The high frequency resistance of the antenna system at 360 meters wave length is approximately 12 ohms, a large percentage of which is radiation resistance. The antenna current at 500 watts is 6.5 amperes; at one kilowatt it is 9 amperes.

The power equipment consists of two 2-kw. motor generator sets with 250 volt direct-current motors, the current employing two armature windings and two commutors permanently connected in series. Normally the motor generator sets are used with the generators parallel. Either set may be used alone with the radio set at reduced power. There is also a third motor generator set with a 220 volt 25 cycle motor which can be connected to the radio set in case of failure of the direct-current supply. This set is provided with an exciter to supply the field of the high voltage generator. A filter consisting of a 50 henry inductance and 32 microfarad condenser reduces the generator hum to a negligible amount. The panel beneath the speech am-

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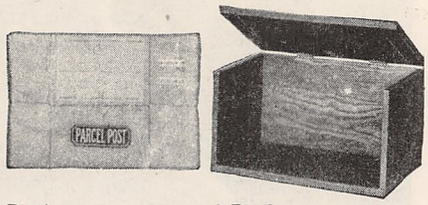
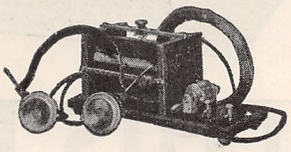


Panel Size	Price	Panel Size	Price
6x7"	$1.50	9x14"	$2.75
6x10½"	2.00	12x14"	3.25
6x14"	2.00	12x21"	3.65
6x21"	2.50		

Above sizes 7" deep inside. Above sizes 10" deep inside

RADIO SET

$3.95



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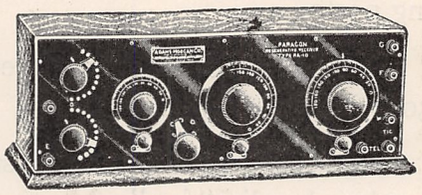

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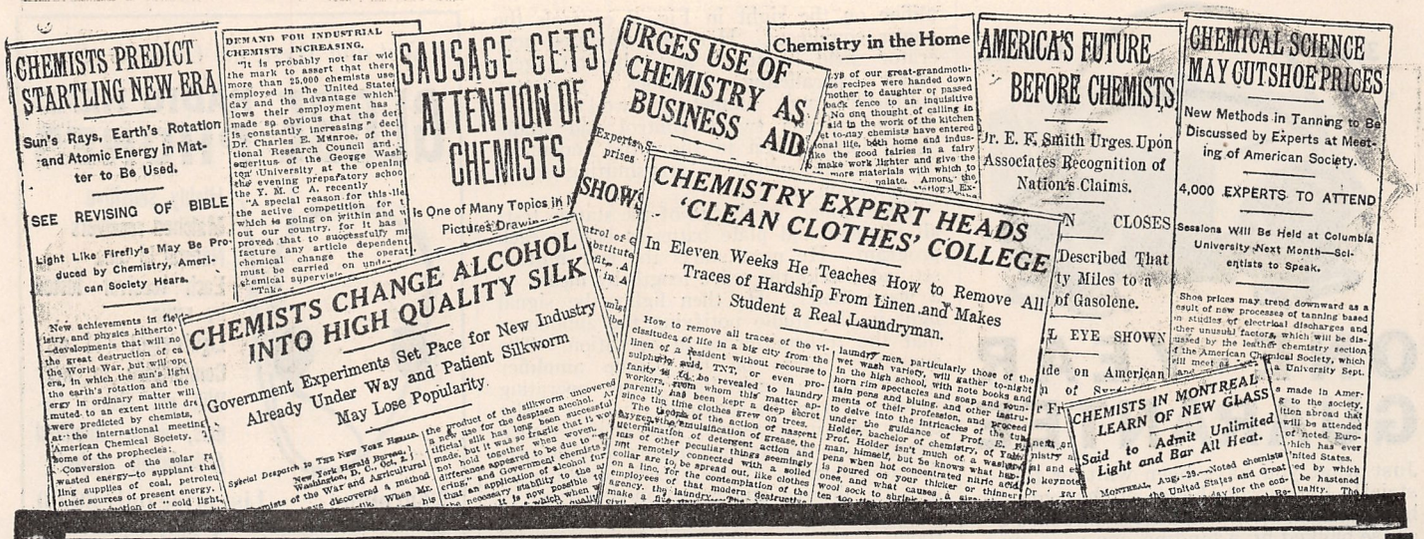

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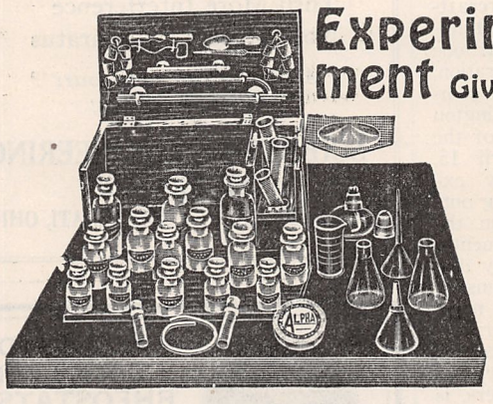

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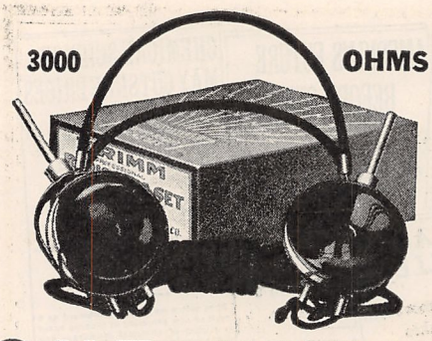

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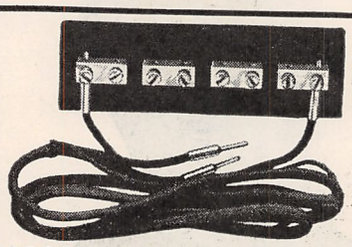
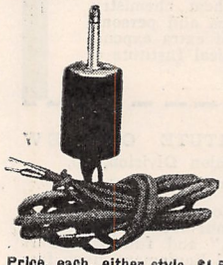
Special Introductory Price, only $10.00, with privilege of five days' trial. We prepay charges. Your money back if you return it. See below how to order.



TRIMM MULTI-PHONE Connectors

For connecting 2, 3, 4 or 5 additional head sets to audion tube or crystal detectors. Type "A" (illustrated above) for connecting head sets in series—the only proper method for lamp detector sets. Does not diminish the sound or tone by dividing it between the extra head sets. Type "B" (not illustrated) for connecting head sets in multiple—the only proper method for crystal receiving sets.
Prices: For 2 head sets, $1.00; for 3 head sets, $1.25
For 4 head sets, $1.50; for 5 head sets, $1.75
Order any TRIMM product on 5 days' trial. Your money back if you return it. We ship direct or through your dealer. Write today for folder. Or mail your order at our risk.



TRIMM 2-Way PLUGS

Style "A" for connecting two head sets in series. Intended expressly for and the only correct plug for use with lamp (vacuum tube) detector sets. Style "B" for connecting two head sets in multiple. For use only with crystal detector sets.

Price, each, either style, $1.50, postpaid. Be sure to state style wanted.

DEALERS: Trimm Radio specialties have no real competition. Our wholesale and retail distributors are fully protected. Write for quantity discounts and full particulars. We ship your first order on approval.

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plifier on the right in Fig. 2 controls the power equipment. Here are mounted generator field switches and rheostats, generator paralleling switches, generator voltmeter and ammeters, voltmeter switch, antenna switch control and studio signal light button to show the announcer in the studio when the transmitting set is in operation.

The engineer-in charge of the station tests all filament and plate batteries before each program. He next starts the transmitting set and checks the wave length by means of a wave meter. He then lights the signal light in the studio notifying the announcer that the transmitter is in operation. The announcer turns on the studio amplifier which lights a signal light in the operating room notifying the engineer that the audio circuits are in operation. The engineer then watches the modulation meter and adjusts the amplification of the speech amplifier to give the desired amount of modulation. A loud speaking receiver in the operating room serves as a check on the quality of the transmission. When programs from local churches or from the downtown studio are to be transmitted, the telephone line is tested beforehand. Orders and any special arrangements are made over a supplementary order wire or phone line between the radio station and place of performance.

The Antenna Unique

(*Continued from page* 617)

and vegetables, information calculated to be of particular benefit to farmers and fruit-growers in the District of Columbia, Maryland, Virginia, West Virginia, and Pennsylvania. This "marketgram" gives the prices on fruits and vegetables in wholesale quantities on the Washington, D. C., market. Forecasts of weather conditions had already preceded the "marketgram," the hour of ten o'clock being allotted for this purpose. The conditions of the upper atmosphere are again being made known by radio-telephone at 9.50 p. m., the wavelength in both instances being 1,160 meters.

The government radio station operated by the United States Post Office Department is not only equipped for both sending and receiving of communications, but both radio-telephony and radio-telegraphy are employed in its broadcasting service. Originally, when this radio station was established, only a two-kilowatt arc-transmitter, modified to increase its strength to four kilowatts, was employed. The original purpose of wireless installation in the Post Office Department was to facilitate the use of the aircraft-mail service, then transporting 200,000 letters daily by air-going machines. At one time, 15 air-mail stations were in operation, radio-telegraphy being the means of communication between them and Washington headquarters. With the introduction of the radio market news service on April 15, 1921, the station was automatically expanded. A radio-telephone transmitting outfit, capable of putting 14 amperes in the antenna at 1,160 meters, was subsequently installed. For a time, radio-telephony displaced radio-telegraphy, but in the plans of broadening the range of operations, more recently, both of these instruments of rapid-fire communication are being employed.

A continuous-wave tube transmitter, operating at a wave-length of 1,980 meters, is pressed into service at 12.30 daily, with the exception of Sundays and holidays. At this hour, the live-stock market reports from Chicago and St. Louis are given wide circulation through the medium of electro-magnetic waves. Again, at 2.15 o'clock p. m., the conditions of the live-stock markets at Chicago and St. Louis are made known by radio-telegraph, the wave-length used being 1,980 meters. The prices of fruits and vegetables are broadcasted by the use of the tube transmitter at 3.30 p. m. At 5 o'clock p. m., the prices of dairy products

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GLOBE RADIO HEAD PHONES

Highly sensitive
Matched receivers
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Each receiver tested by radio
Lightweight (11 oz.)
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2200 ohms **List price only $9.00**

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Ask about the Globe Antenna Attachment Plug for connecting your radio set to your electric light circuit.

Buy from your local dealer, or write us direct.

We are also the sole distributors of the Globe Vactuphone, invention of Earl C. Hanson, the only hearing device made for the deaf using the vacuum tube amplifier.

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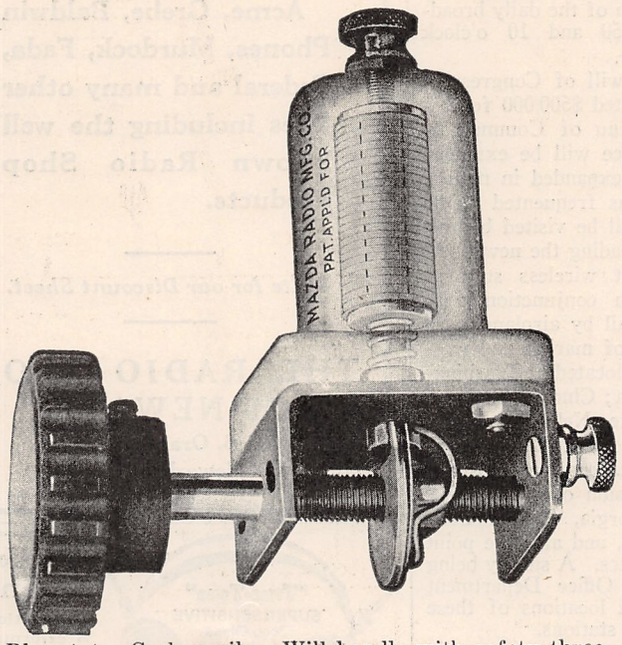
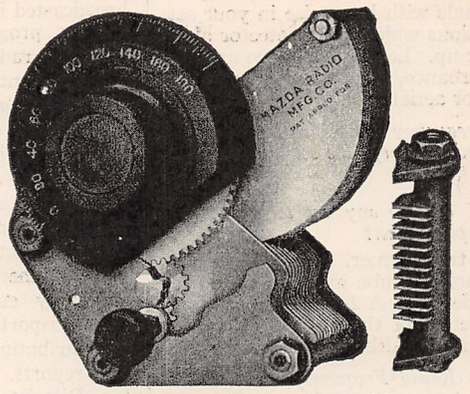


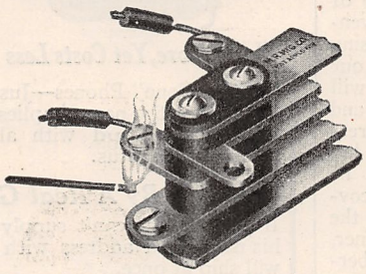
Rheostat.—Carbon pile. Will handle with safety three detector amplifier tubes. Gives extremely delicate filament control over critical range. Price $1.75

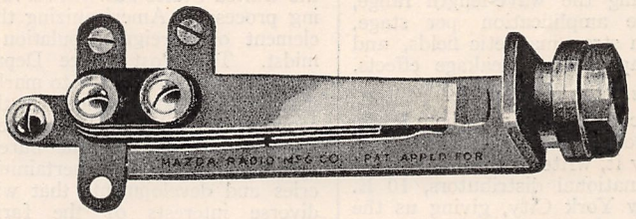


Variable Condenser.—Vernier control without separate vernier, produced by improved plate design. Micrometer adjustment obtained by 12 to 1 built in gear drive. Entirely new plate spacing construction throughout insures positive alignment. Prices: 3 Plate $3.00, 23 Plate $5.50, 43 Plate $7.00.

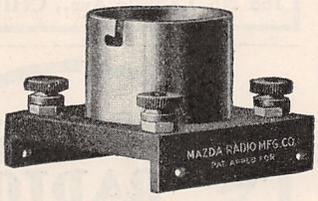
Senior Plug.—A handsome, highly finished standard plug. Price $1.00.

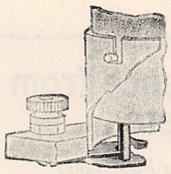
Junior Plug.—A popular priced, fool proof plug. Easily connected. Price $.60





Jacks.—Suitable for all plugs. Ears designed for accessibility and equipped with screw, nut and fusible washer. Solder with a match. Prices: Open Circuit $.65, Single Circuit $.75, Double Circuit $.90, Filament Control—Single Circuit $1.00, Filament Control—Double Circuit $1.25.





Socket.—Heavily GOLD plated, non corrosive contact springs. Separate side and bottom positive contact for each tube prong. Prices: Composition Style $1.00, Composition Base, Metal Shell $1.25.

Variable Fixed Condenser.—Designed to insure rated capacitance. Made in four sizes. Prices: .00025 Mfd. $.30, .0005 Mfd. $.30, .001 Mfd. $.40, .002 Mfd. $.50.

The above articles are only a few of those being marketed, all of which contain unusual features, provide for accessibility, ease of assembly, and are correct in their electrical and mechanical design. We manufacture everything for the radio fan except tubes and batteries, each article being produced and tested in several styles and sizes, and sold at prices surprisingly low for the high quality of our product.

Most Complete Line of Radio Parts

THE MAZDA RADIO MANUFACTURING COMPANY

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Subsidiary of The Simmons Mfg. Co., Largest Independent Manufacturers of Automobile Replacement Parts in the World

Radio Frequency Amplifying Transformers

What is Radio Frequency Amplification?

Radio Frequency Amplification is the increasing of the strength of radio signals or waves before they are applied to the detector tube, where they are made audible.

What results will I get by adding Radio Frequency Amplification to my set?

Louder signals with less noise in your set; distant stations which your detector alone cannot pick up. Less interference and less static disturbance, particularly if you use a loop indoor aerial.

Can Radio Frequency Amplification be added to any standard make of tube set to advantage?

Yes.

What must I add to my set to use Radio Frequency Amplification?

One radio transformer, one tube socket and one amplifier tube must be added for each stage desired. A 200 ohm potentiometer, irrespective of the number of stages, is an advantage, although not necessary.

How should a Radio Frequency Transformer be constructed to insure maximum efficiency?

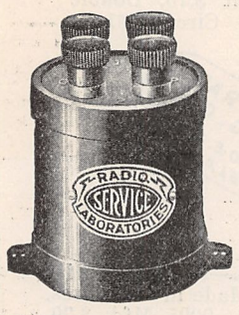
An efficient radio frequency transformer is preferably built with a closed magnetic circuit to prevent undesirable oscillations or whistling sounds and should, therefore, employ an iron circuit and iron shielding to eliminate stray magnetic fields.

What Radio Frequency Transformer is built that way?

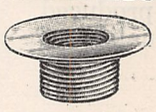
The transformer manufactured by the Radio Service Laboratories, Inc., is built on this engineering principle. The comminuted iron closed core (a special form of divided magnetic material) completely encloses the bobbin or transformer windings thus broadening the wave-length range, increasing the amplification per stage, shielding from stray magnetic fields, and eliminating capacity and leakage effects.

Where can I obtain this transformer?

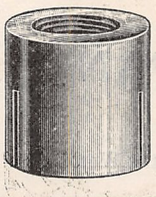
At any electrical shop or store where Radio supplies are sold. If your nearest dealer does not carry it, write to the Rasla Sales Corporation, national distributors, 10 E. 43rd St., New York City, giving us the dealer's name and we will see that you are promptly supplied.



ATTENTION RADIOTICS



IF you use Amplifying Tubes you can make your Victor talking machine a RADIO LOUD SPEAKER, with a



"BEEKO"
Radio-Phone attachment

Liberal Discount in Quantities

J. H. Bunnell & Co.
Department X
32 Park Place, New York

in New York and Chicago are sent out by radio-telephone, operating on 1,160 meters. The condition of the grain market is revealed to the public at 5.30 p. m. by radio-telegraph, the wave-length employed being 1,980 meters. Again, the radio-telephone is pressed into service at 7.30 and 8 o'clock p. m. when the fluctuating tendencies of the prices of livestock, grain, fruits, and vegetables are scattered through the medium of electrical waves. Weather reports are broadcasted in conclusion of the daily broadcasting program at 9.50 and 10 o'clock p. m. by radio-telephone.

Contingent upon the will of Congress in appropriating the requested $500,000 for establishment of a "Bureau of Communication," the wireless service will be extended in its reach as well as expanded in nature. Isolated areas as well as frequented points in the United States, will be visited by this hurry-up method of spreading the news. At present, there are eight wireless stations, originally established in conjunction with the transportation of mail by airplane, used as distributing agencies of market and weather reports. These are located at Washington, District of Columbia; Cincinnati, Ohio; Omaha and North Platte, Nebraska; Rock Springs, Wyoming; Elko and Reno, Nevada. Radio-telephone stations, in prospect, by reason of the expansion of the service, will be located in Georgia, Texas, California, Montana, Illinois, and at some point in the New England States. A survey being conducted by the Post Office Department will determine the exact locations of these information-distributing stations.

The Post Office Department voices the belief that the widespread dissemination of government knowledge will not only prove of economical value to a varied citizenry of the United States but will serve as a leavening process in Americanizing the increasing element of foreign population within our midst. The Post Office Department will not only give circulation to market news and weather forecasts, in the event that Congress sanctions an enlargement of the service, but the different government bureaus will be drawn upon for facts pertaining to discoveries and developments that will serve the diverse interests of the farmer, miner, rancher, fruit-grower, forester, and lumberman. Then, too, the public in general can appropriate to advantage much of the information circulating through space by reason of its practical value and entertaining quality.

Correspondence from Readers

(*Continued from Page* 630)

speech being easily understandable, but—that's not all. On the night of March 28, I distinctly heard a concert in progress at Schenectady, N. Y., broadcasted by WGY. His speech was easily understandable. I have heard him a few times since. All this was on Galena using a double slide tuner in connection with a four-wire aerial hung very low, about twenty-five feet above ground. I've also copied regularly NAA since Dec. 12, 1921. In the winter he was readable with the phones three inches from the ears. I agree with G. W. Perkins as to broadcasting stations signing more often, as it has been my own experience to fuss around part of an evening just to catch a station's call.

SHIRLEY C. NEIS.

Lodi, Wis.

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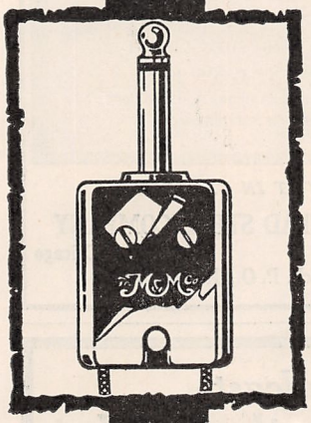

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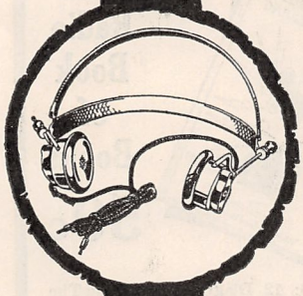
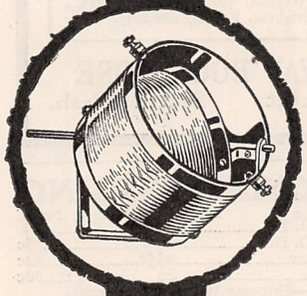


M & M Head Phones

They are unusually sensitive; special attention being given to matching perfectly the tone in both receivers. The magnets are made of finest grade of magnet steel and properly aged before assembly. The receivers have aluminum cases and the earcaps are of moulded Bakelite. A rear cap prevents connections from being jerked lose. All metal parts heavily nickel plated. Shipping weight, 1 pound. Price..... **$10.00**



180° Vario Coupler

Designed primarily for use in the popular single circuit tuner. The secondary coil is two-layer bank wound so it will respond to any wave-length covered by the primary; furnished also with single layer winding, if desired. The secondary leads are brought out thru spring contacts on the shaft, insuring positive connections at all times. All metal parts nickeled. Wave-length 170 to 600 meters. Shipping weight, 1 pound.
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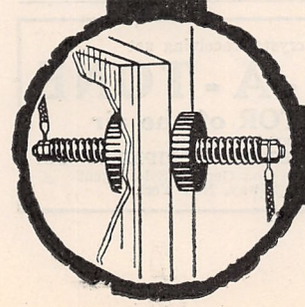

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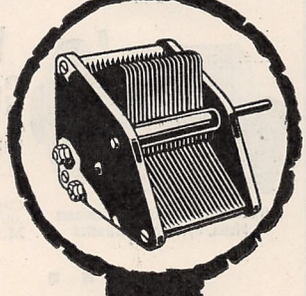

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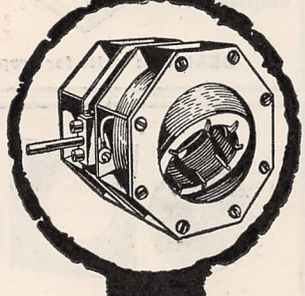
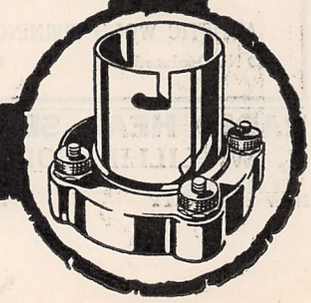


M & M Variometers

This special design with the skeleton rotor and stator reduces the usual losses found in most other variometers. The coils are form wound, the turns being held together with RadioVar. The skeleton frames are made of 1/16" black fibre securely cemented together; the windings are secured to the frames at eight different points. Metal parts are nickel plated brass. Wave-length 170 to 500 metres. Price..... **$5.00**



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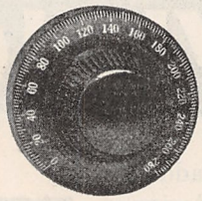

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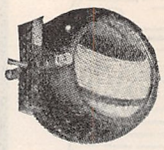

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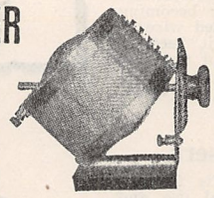

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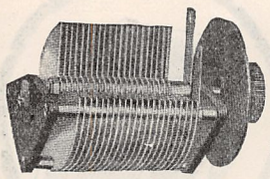

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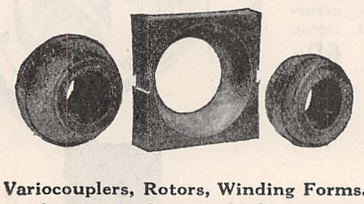

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SIGN OFF MORE CAREFULLY

Editor, RADIO NEWS:

As a subscriber to your RADIO NEWS magazine, I take this privilege of calling your attention to a matter which I consider of great importance.

Out in this country there seem to be a number of broadcasting stations which fail to make a good job of signing off. I have been wondering if you could reach these stations through your magazine and make it impressive to them by publishing an article requesting them to be more careful in signing off, as we radio fans would like to know who we are listening in on and would be glad to write to them as per their request.

C. M. STENBERG.
Genoa, Neb.

CONSTRUCTIVE CRITICISM

Editor, RADIO NEWS:

In the August issue of RADIO NEWS there appeared on page 235 a letter by Mr. Henry Morris of Monravia, California. Because the short-sighted letter was made still more misleading by the heading "When, Oh when will it stop?" I wish to answer that communication.

There is a remote possibility that conditions are as bad as Mr. Morris paints them. At present California, especially near San Diego, holds the unpleasant distinction of being a center of radio anarchy. As in municipal affairs, so also in radio, the conditions of a city are always a direct reflection of the citizen mind. Where the population takes an active interest in governmental affairs, joins in citizen's meetings and becomes directly acquainted with those in power, there will be an intelligent understanding of the evils of government and because the law-abiding citizen is acquainted with others of his kind, they can, by force of united action and opinion, cure those evils without a civil war.

On the other hand, if the citizen stays away from public meetings and writes appeals to the National Government and to the magazines (however eminent the latter may be) he will continue to endure the same conditions with only himself to blame.

But are things really as stated, Mr. Morris? Are you not one of those who uses a crystal receiver or perhaps single circuit tube set?

Whatever may be the merits of those devices they are admittedly unable to do away with local spark interference as well as the coupled tuners. True, the single circuit attains selectivity when the tube is made to oscillate, but it is not so used by the broadcast listener.

Wherever the user of the single circuit is situated near a strong spark or arc station there will be discontent on his part as to the interference conditions, and only too often he is blaming the amateur for that interference when the call of the "rock crusher" in question begins with an "N" or a "K" or a "W."

Therefore, I wish to suggest to Mr. Morris and to others who write similar letters that he first go over his own receiver in a highly critical frame of mind, then (if the set passes inspection) that he go out and join a radio club, become active in its ranks, learn to know the men who create the interference and by force of education, club opinion and just possibly by law cure those men of the practices in question.

The National Government cannot be expected to settle these local quarrels, nor has it any such intentions, as is shown by the provisions of the new law which, in contradiction to the impressions of Mr. Morris, is designed to restrain the broadcast station rather than the amateur.

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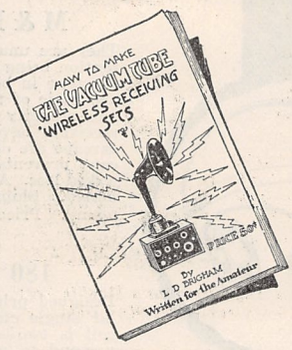

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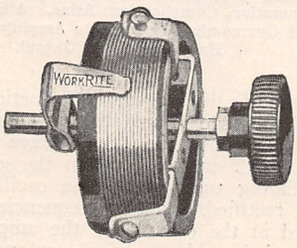

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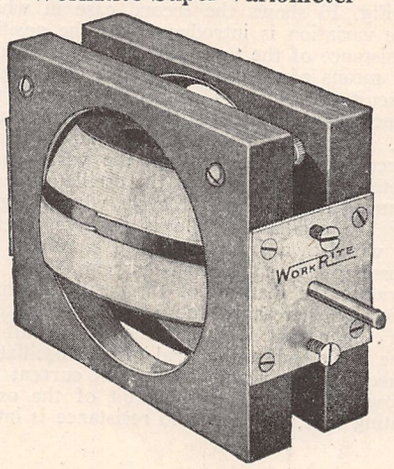

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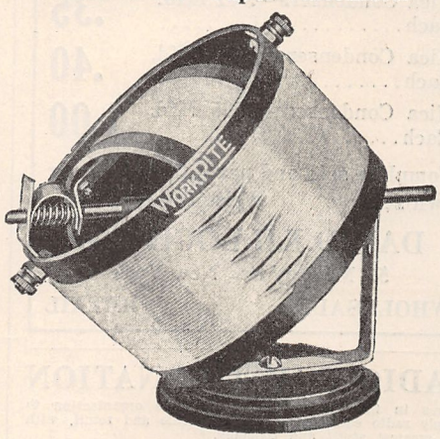

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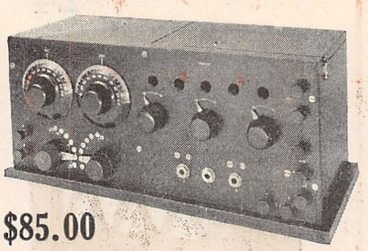

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ANGIERS, U. S. A.
Bruce St. Plant Streator, Ill.

Some Recent Developments of Regenerative Circuits

(*Continued from page 619*)

The rate of variation in the relation between the negative and positive resistance is a matter of great importance. It may be at sub-audible, audible, or super-audible frequencies. In radio signaling, for the reception of telephony, the variation should be at a super-audible frequency. For modulated continuous wave telegraphy and spark telegraphy, to retain the tone characteristics of the signals, it must be well above audibility; for maximum amplification a lower and audible rate of variation should be used. In continuous wave telegraphy, where an audible tone is required, the variation is at an audible rate; where the operation of an

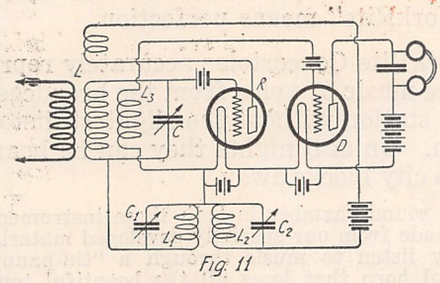


Fig. 11

This is the Method Employed for Simultaneously Varying the Positive and Negative Resistances of the Regenerative Circuit. A Separate Detector Tube is Used.

indicating device is required, a sub-audible frequency may be best. The choice of frequency is a compromise, particularly in telephony, since obviously the lower the frequency the greater the amplification, and the higher the frequency the better the quality.

Some practical forms of circuits are illustrated by Figs. 9, 10 and 11, which illustrate respectively the three types of variation. Fig. 9 shows a method of varying the plate voltage coupled into the plate circuit. In this arrangement a third tube acts as a detector. This is essential when an audible frequency is employed; when a super-audible frequency is used the telephones can be placed directly in the plate circuit of the amplifying tube.

Fig. 10 shows the second case in which the variation is introduced into the positive resistance of the tuned circuit. This is done by means of an oscillating tube O, the grid circuit of which is connected through the tuned circuit LC of the amplifying tube R. The variation in the resistance of the circuit is effected through the variation in potential of the grid of the oscillating tube. During that half of the cycle, when the grid of the oscillating tube is positive, energy is withdrawn from the tuned circuit in the form of a conduction current from the grid to the filament of the oscillating tube, thereby increasing the effective resistance of the circuit. During the other half of the cycle, when the grid of the oscillating tube is negative, no conduction current can flow through the grid circuit of the oscillating tube, and hence no resistance is introduced into the tuned circuit of the amplifying tube. In this case the amplifying tube serves also as the detector for any frequency of variation, as the tuned circuit forms a sufficiently good filter even for an audible frequency to prevent a disturbing audible tone in the telephones.

Figure 11 illustrates the case of a simultaneous variation in both positive and negative resistances. This is accomplished by providing the amplifying tube R with a second feed-back circuit L_1C_1 and L_2C_2 adjusted to oscillate at some lower frequency, thereby introducing a variation in the negative resistance through the variation of the plate potential of the amplifier and a variation in the positive resistance by means of the variation of the grid of the amplifier. The proper phase relations between the negative and positive resistance are obtained by adjustment of the capacity of condensers C_1 and C_2 and the coupling between L_1 and L_2. In operation this system is very critical, and extreme care is necessary in order to obtain the super-regenerative state.

In each of the preceding cases the detecting function has been carried out either by a separate tube or by means of the amplifying tube. When a super-audible frequency of variation is employed, it is sometimes of advantage to perform the detecting function in the oscillating tube, and a system for carrying this out is illustrated in Fig. 12. The operation of this system is as follows: incoming signals are amplified by

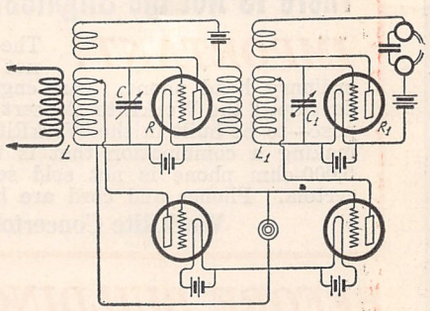


Fig. 14

In Using Cascade Amplification with the Super-Regenerative, Complications Arise. A Simple Manner of Overcoming These is to Amplify the Second Harmonic of the Output.

means of the regenerative action of the amplifier tube R and the variations of potentials across the tuned wave frequency circuit LC impressed upon the grid of the oscillating tube O. These oscillations are then rectified, and two frequencies are produced in the circuits of the amplifier tube. One of these frequencies corresponds to the frequency of modulation of the signaling wave. The other corresponds to the frequency of the variation and contains a modulation in amplitude corresponding to the modulation of the transmitted wave. This second frequency is then impressed upon the circuits of the oscillating tube

Continuous Oscillations Occur When it is Attempted to Use Tuned Circuits Between the Antenna and the Amplifier. These Can Be Avoided by the Super-Heterodyne Method of Amplifying a Different Frequency.

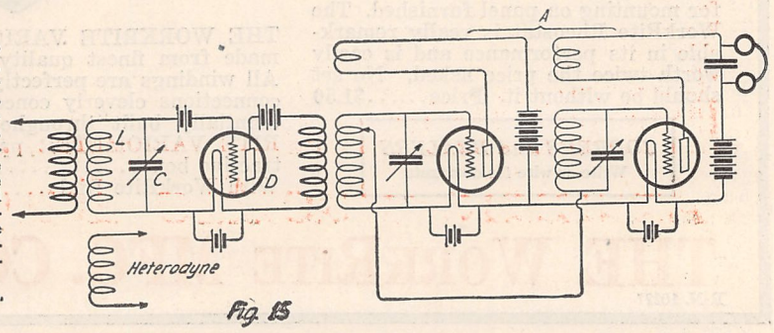


Fig. 15

no ground aerial

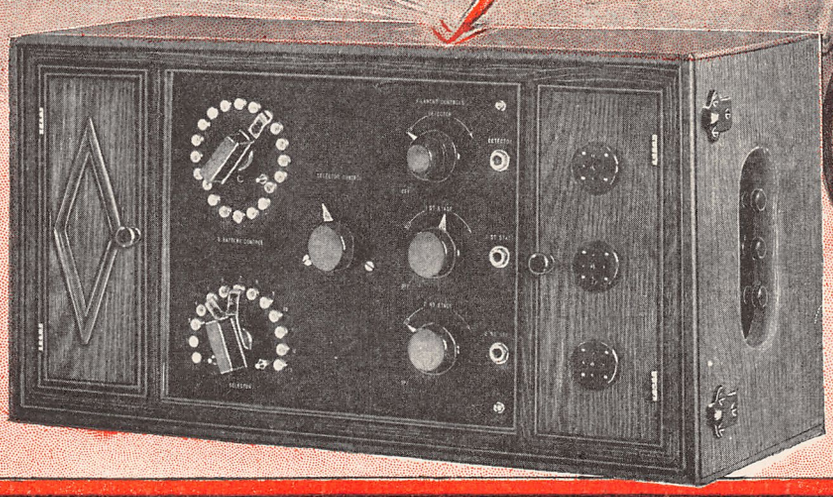
The Oard PHANTOM no ground circuit used in–

The A-P Special RECEIVING SET

One of the most important, most revolutionary developments since the discovery of radio. The receiving set thousands have been waiting for. A set that requires no ground, no aerial. For general use a single wire not exceeding 15 feet in length, concealed in the picture moulding, laid on the floor, or, if out-of-doors, placed on the ground, is all that is necessary. Stations 400 miles distant have been heard under these conditions. For distant service a wire not over 50 feet long will produce better results than can be obtained with the elaborate 150 to 200 foot aerial and ground, or loop system required by other types of receivers.

The *A-P Special* has the apparent advantages of radio frequency amplification without its delicate and complicated adjustments. It is remarkable for its simplicity of control and marked selectivity, and ideal both as a home set and for use as a portable in camping or outing.

Bulletin B contains complete information on this wonderful set. Write for it and name of our nearest dealer. We are now in position to make prompt shipments.



Set closed with cover for use as a portable

U.S. AND FOREIGN PATENTS PENDING

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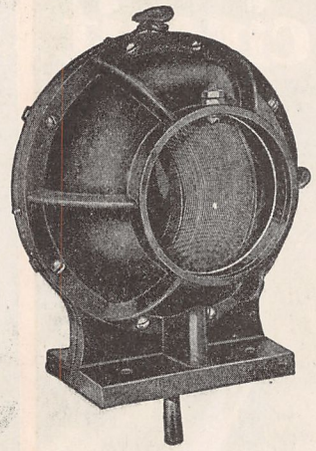
The Hit of New England

SE-AR-DE

Radio Products



SE-AR-DE Variometers are made of genuine molded bakelite, wave length range 180 meters to 580 meters, stator wound with single cotton covered wire, rotor with single green silk wire, mid point of stator winding brought out for first tap in single circuit tuner. The only variometer to which a bank wound inductance can be conveniently attached. It has lower dielectric losses and higher efficiency than any similar article on the market. No friction contacts, the rotor connections are pig-tailed to two binding posts on the rear.

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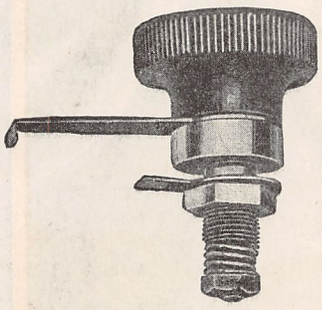

SE-AR-DE Switches are made in 1⅛"-1½"-1¾" radius—Single contact and 1¾" radius Dead Ending types—with Thermoplax knob (no shellac), all parts nickel plated, contact arm and bushings nickeled and hand buffed—Each switch is packed in individual box.

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with which it is in tune, amplified by the regenerative action of the system $L_1C_1L_2O$ and then rectified. The amplification obtainable with this form of system is considerably greater than that of the single amplification circuits, but is naturally more complicated to operate.

When a super-audible variation is employed in a system such as illustrated in Fig. 1, it is generally necessary to introduce a certain amount of resistance in the tuned circuit to insure the dying out of the free oscillation during the interval when the resistance of the circuit is positive. This is most effectively carried out by means of the arrangement illustrated in Fig. 13, in which a secondary coil L_1 of large inductance and high resistance is coupled to the tuned circuit LC and the energy withdrawn thereby from the oscillating circuit stepped up and applied to the grid of the tube. In the operation of this system, a curious phenomenon is encountered. This is the manifestation of an inductive reaction by the plate circuit of the amplifying tube to the auxiliary frequency emf. supplied the plate circuit by the oscillating tube. This comes about in the following way. When the auxiliary emf. is impressed upon the plate of the amplifying tube, a current is produced in this tube in phase with the emf. across the tube. Now suppose the plate voltage is at its maximum positive value. This means that the negative resistance of the circuit is a maximum in amplitude. This in turn means that the average value of the grid is becoming more positive and the current in the plate circuit is likewise increasing. Since the free oscillation in the system will increase in amplitude as long as the resistance of the circuit is negative, it will reach its maximum amplitude after the maximum positive voltage is applied to the plate. Hence the component of current corresponding to the frequency of the variation set up in the plate circuit by the rectification of the radio frequency oscillations lags in phase behind the auxiliary emf. impressed on the plate. Hence the plate circuit of the tube manifests an inductive reaction to the auxiliary emf. It was found that this inductive reaction could be tuned out by means of the parallel condenser C_1 with great improvement in the stability of the operation of the system and increase in the signal strength. The resonance point is pronounced, and once the other adjustments of the system have been correctly made, is as readily found as any ordinary tuning adjustment.

The problem of cascade amplification with these systems is a rather involved one on account of a great number of effects which are not encountered in ordinary methods of cascade amplification. The principal trouble is the reaction of the second amplifying system on the first, and the difficulty of preventing it in any simple way on account of the high amplification per stage. While this difficulty is not insuperable, a simple expedient may be employed which avoids it. On account of the large values of radio frequency energy in these amplifying systems, the second harmonic is very strong in the plate circuit of the amplifying tube and is of the same order of magnitude as the fundamental if the tube is operated with a large negative voltage on the grid. Hence by arranging the second stage of a cascade system to operate at double the frequency and to amplify this harmonic, the difficulty is avoided. The general arrangement of such a system is illustrated by Fig. 14, in which the positive resistance of the circuits LC and L_1C_1 of a two-stage amplifier are varied synchronously by a single oscillator. The circuit L_1C_1 in this case is tuned to the second harmonic of the circuit LC, but the combinations of circuits which may be arranged on this principle are very numerous.

One of the curious phenomena encountered with the super-regenerative system is

Regal Radio Products

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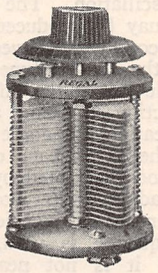

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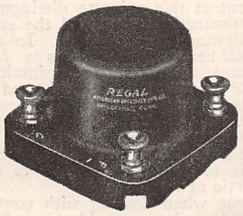

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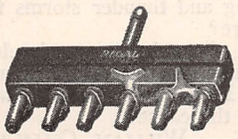

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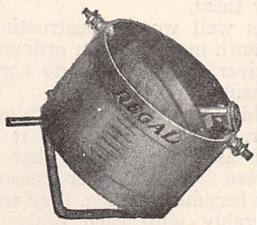

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Here Are Five Big Reasons for the Enormous Sale of "*Regal*" Receivers

1. Designed by our own radio engineers and a scientific precision instrument simple and easy to operate. 2. Built entirely in our own factory with all "REGAL" parts. 3. Has a guaranteed wave length from 150 to 1800 meters. 4. Backed by our thirty years' experience in the manufacture of precision instruments. 5. Priced at $40.00 instead of $100.00—reason, we build it ourselves.

(Under actual test in our testing laboratory in Bridgeport, Conn., on the evening of July 12th, we brought in a very beautiful concert from station WOH, Indianapolis; concert and base ball scores from station KDKA, Pittsburgh; Marine Band concert from station NOF, Washington, D. C.; Concert, weather and market report from station WJZ, Newark, as well as several other stations. This test was with one tube and without the use of the Regal Two-stage Amplifier.)

"*Regal*" Vacuum Tube Receiver $40.00

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Can be added to "*Regal*" Receiver to triple range and audibility.

Some Excellent Features of the "*Regal*"

Minimum number of controls, all clearly marked, with taper knobs and etched silver dials. Unique Regal Telephone Connector, permitting use of three pairs of head phones (doing away with all jacks and plugs) Fine Regal Potentiometer Plate control—so necessary to efficient tuning of modern vacuum tube detector. New Regal Rheostat (6 Ohms—2.2 amperes) New Regal Inductance switch, doing away with all unsightly switch points and levers and insuring fine electrical connections. Regal 43-Plate Condenser. Regal Tube Socket. Mahogany piano finished cabinet with satin finish panels. Rear panel connector, for antenna, ground, batteries, etc., doing away with all crude looking wires in front of cabinet.

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A quality instrument that is 100 per cent efficient 15 point switch complete in one unit. Does away with usual awkward and unsightly job of single threaded switch points bolted to panel. Requires but one hole to mount on panel. Smooth wiping contact over heads machined to same height on one piece contacts. Complete soldered assembly attached, or removed from panels by means of one threaded shaft bushing. Gives inductance regulation by dial contact. THE BIGGEST HIT IN RADIO. Complete with Knob and Dial.

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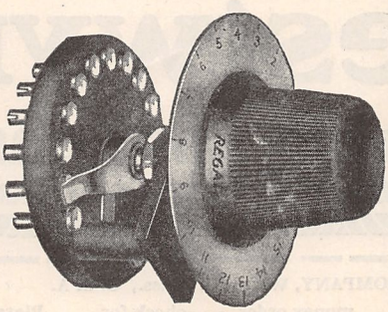
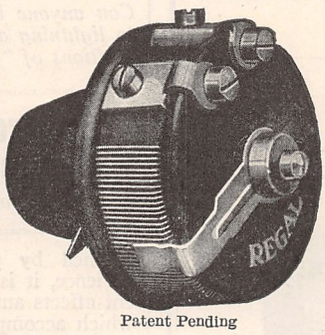


Patent Pending



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Your Receiving Set is worthless without a good Rheostat. The "REGAL" is mechanically perfect. Has full exposed resistance wire, giving critical adjustment so necessary to the efficient operation of a vacuum tube. Fine, smooth working control. Handsome knob, heat resistance base and highly nickel plated parts. 6 ohms resistance—2.2 amperes.

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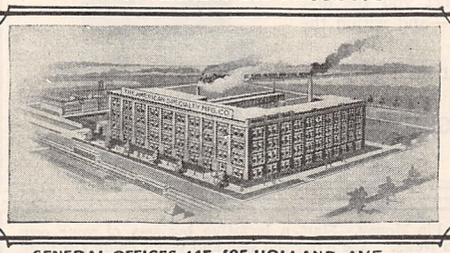

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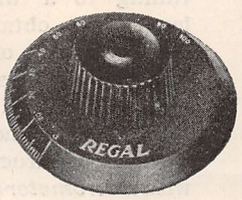

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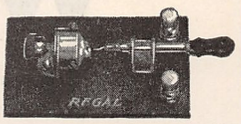

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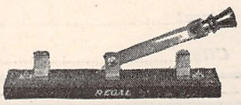

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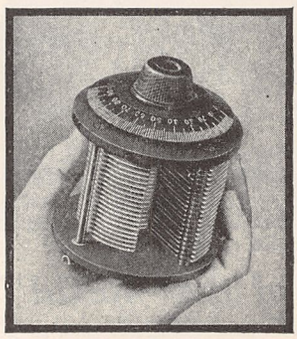
"How to make your radio set work best"

IN ORDER to make your radio set work, let us briefly consider the requisites necessary and then apply a definite method to achieve this end.

To receive signals of maximum intensity, the open and closed circuits of the receiver *must be accurately tuned to each other and to the frequency of the incoming wave.* Tuning in the circuits of a radio receiver is accomplished by means of the variable elements of inductance and capacity.

The best results in tuning to a wave length are obtainable by means of a variable condenser, always providing that this instrument has been constructed with *micrometer exactness* as is the Westwyre Variable Condenser.



Not only does this instrument enable you to more readily *select the station you desire* where two or more are broadcasting at approximately the same wave length, but it *tends to increase the strength of incoming signals* and *eliminate interferences* from near-by stations which ordinarily drown out those farther off.

In a weighing operation, weights of several pounds are first placed on the scales, while the delicate balancing is accomplished by a sliding beamweight. So in a radio set the inductance may be varied in rather large steps while the finishing off is left to one or more Westwyre Variable Condensers which are capable of exceedingly fine wave length adjustment.

43 plate, .001 mfd. with dial.....$5.00
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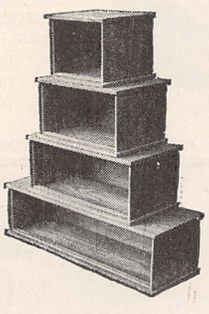

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found when it is attempted to secure sharp tuning by the use of tuned circuits placed between the antenna and the amplifying system. The free oscillations set up in these circuits by the reaction of the amplifying system continue in these circuits during the interval when the resistance of the amplifier circuit is positive, re-excite the amplifier when the resistance becomes negative, and hence the entire system is kept in a continuous state of oscillation. The effect is most critical, and may be produced with most extremely weak couplings between the amplifier circuit and the second tuned circuit. The simplest solution of the difficulty is to perform the function of tuning at one frequency and amplification at another, and this is best accomplished by means of the super-heterodyne method illustrated by Fig. 15. This may be adapted to work on either the sum or difference frequencies, but when the higher frequency is used, care should be taken that it is not near the second harmonic of the local heterodyning current. In the particular arrangement illustrated, *LCD* represents, together with the heterodyne, the usual agency for changing the incoming frequency, and *A* represents the super-regenerative amplifier which may be of any suitable type.

[1]It is very important at this point to distinguish between this purely theoretical state and the state which exists in oscillating tube circuits. In the various forms of self-heterodyne circuits a free oscillation of constant amplitude is maintained in the system and the circuit may be considered as having zero resistance, *but only for that particular amplitude of current.* An external emf. impressed on the circuit always encounters a positive resultant resistance, assuming, of course, that the existing oscillation is stable. This is due to the non-linear characteristic of the tube.

[2]This is strictly true when dealing with continuous waves which we have been considering. It is not true in the regenerative reception of spark signals, particularly of short wave length, large damping and low spark frequency. In this case the energy in the free oscillation exceeds the energy in the forced oscillation.

THUNDER STORMS

Hoboken, N. J. What has been the cause of all the lightning and thunder storms the last month or more?

I have an idea there is too much electricity in the air due to the many radiophones now being used. Isn't there some one who can tell if this is the cause?

WILLIAM COLLIER.

(*The above item picked from the New York "News" attracted our attention. No doubt the weather has troubles of its own and is pretty much peeved with all the aerial noise going on at the present time. There is no doubt that it has convulsions and fits when it listens to some of our pseudo singers. Can anyone blame the weather for turning to lightning and thunder storms at such exhibitions of "art"?*)

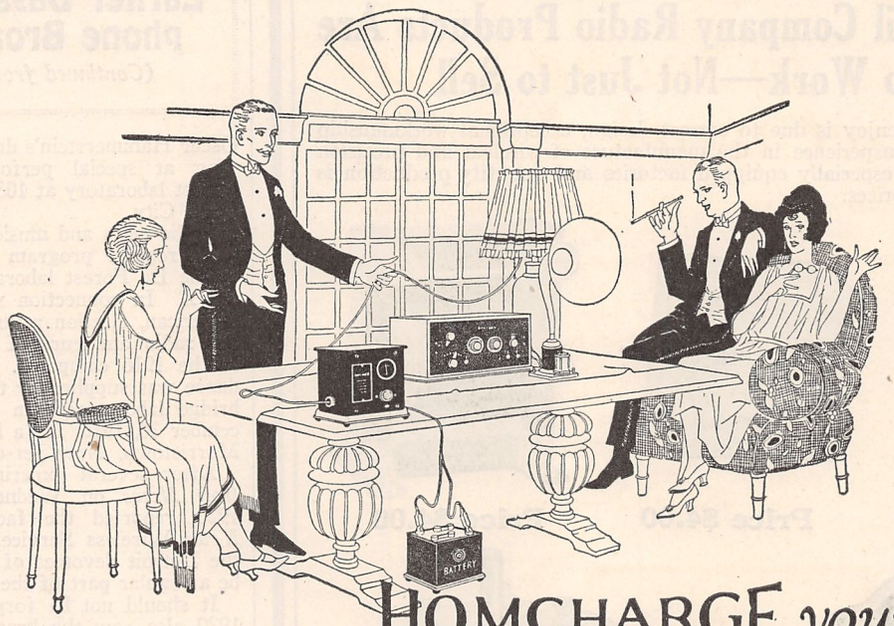
Construction of a Super-Regenerative Receiver

(*Continued from page* 621)

learned by practice. After a little experience, it is not difficult to find the different effects and learn to recognize the sounds which accompany them.

The receiver is well worth constructing. It does not cost much more than an ordinary regenerative receiver and there is no comparison in the results.

An aerial should not be employed with one of these receivers. For one reason, it is hardly necessary, as a loop is all that is required to receive. For another reason, if these receivers become common, they will interfere considerably with each other if they are used in connection with aerials. If a super-regenerative receiver becomes out of adjustment it radiates strongly. This effect is not so noticeable on a loop which will not radiate any great distance.



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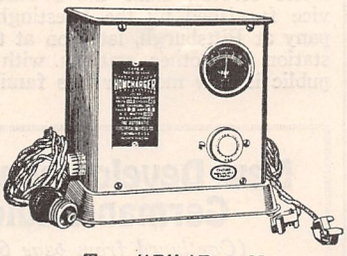
Don't be bothered with the inconvenience and expense of taking your battery to a service station every few days for recharging.



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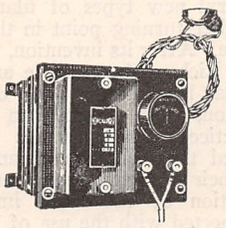

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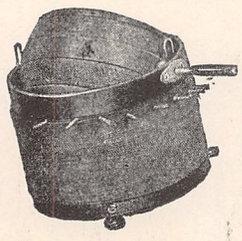

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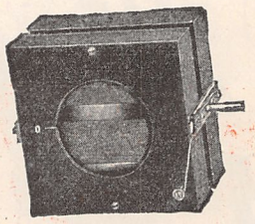

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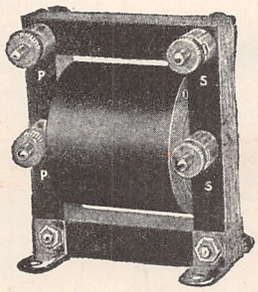

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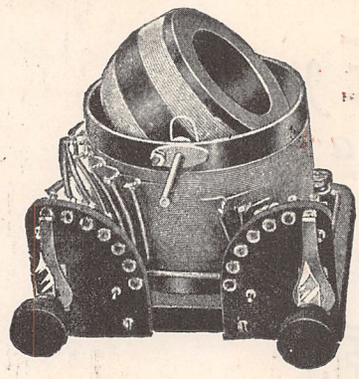

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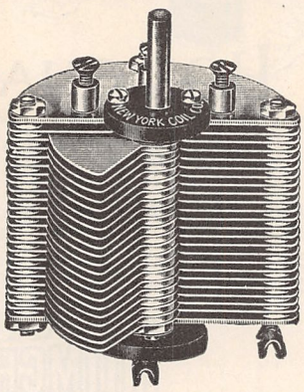

11 Plate.	$1.50
23 Plate.	2.00
43 Plate.	3.00
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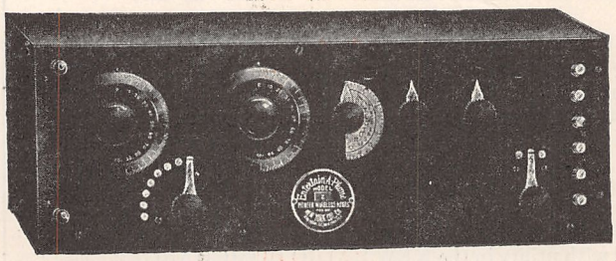

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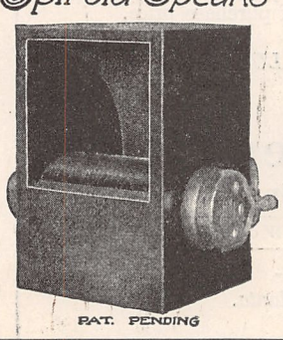

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which uses your own headset—no "units" to buy. The beautiful, compact (8 inches high) **SPIROLA** has a scientifically-designed **SPIRAL** sound chamber *nearly two feet long*. This utilizes *all* the sound and gives it the fulness and richness of the finest phonographs. Satin Black Finish. **$3.85**

SPIROLA DELUXE model, either mahogany finish with bronzed throat or dark oak finish with silvered throat—**$4.85.** At dealers, or postpaid direct—money back guarantee.

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Experimenter Publishing Co., 53 Park Place, N. Y. C.

Earlier Days in Radiophone Broadcasting

(*Continued from page* 621)

Oscar Hammerstein's dramatic soprano, who sang at special performance at the De Forest laboratory at 103 Park Avenue, New York City.

Radio news and music was first furnished on a regular program in the fall of 1916 at the De Forest laboratory in Highbridge, N. Y. In connection with the New York American, election returns were supplied to the radio amateurs of the Eastern States in the 1916 campaign. Music for a radio dance was supplied by the De Forest Highbridge laboratories on the evening of December 30, 1916, for a house party given in Morristown, New Jersey.

After several experimental tests, the *Detroit News* on Wednesday September 1, 1920, reported the fact that the *Detroit News* Wireless Service "for the benefit of the Detroit devotees of the radiophone will be a regular part of the news to the public."

It should not be forgotten that the year 1920 also saw the broadcasting of orchestral music on a large scale from the California Theatre in San Francisco, California, where a daily musical program was furnished to the music lovers on the Pacific Coast.

Following the installation of the *Detroit News* service, came the broadcasting service furnished by the Westinghouse Company at Pittsburgh, later on at the Newark station and other stations with which the public is now more or less familiar.

New Developments in German Radio

(*Continued from page* 634)

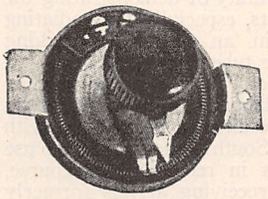
as embodied in the new central station, for the news service of the world, after which Dr. Rukop, director of the vacuum tube laboratory of the Telefunken Company, gave a short account of recent advances in the field of vacuum tubes, the adoption of several new types of filaments constituting another turning point in the development of these. After its invention, in 1905, by Robert von Lieben, the cathode amplifier tube was, a year later, in the form of Lee de Forest's audion, first adopted in general wireless practice. The successes thus obtained induced the leading companies of the world in their laboratories to undertake the investigation of the more important problems connected with the use of vacuum tubes, the work done by the Telefunken people being remarkable in many ways. During the war, the German Wireless Company was, of course, shut off from the rest of the world, but at present, there is a lively exchange of experimental results between it and the other leading concerns of Europe and America.

Some remarkable improvements have, during the last few months, been devised at the Telefunken laboratory, the heating current being reduced and the life of the filament lengthened considerably, while the troublesome noises of the tubes have been reduced to a minimum. These results were obtained by designing some new types of filament for the incandescent cathode, primarily a new and most efficient oxide filament which only uses up about one tenth of the electric energy required by tungsten filaments, while possessing a remarkably long life (in many cases up to 10,000 hours). Two other types of cathode filament were

---stop *this* interference

THERE'S one kind of "interference" that you can definitely eliminate. That's the "interference" from poorly constructed and unskillfully designed instruments. In putting our Teagle radio apparatus on the market, we are giving the radio fraternity the results of years of radio engineering experience. In addition, we are giving the guarantee of The Newman-Stern Co., pioneers in the radio field.

N.B.—Any item on this page at your dealer's, or sent direct from us, prepaid, on receipt of price.



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For panel or table use. Smooth action.

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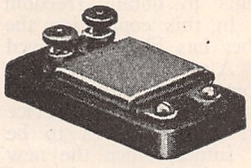

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Mica dielectric. Brass plates; .0005 Mfd.

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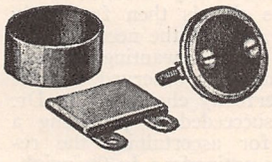

Teagle Grid Leak and Condenser Unit

The only moisture-proof variable grid leak. Screw thread caps. Mica condenser. Brass plates.

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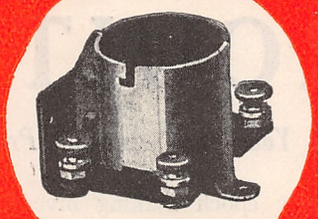
No. T-103. Grid condenser only. Price..... **.40**



The socket that will get your enthusiastic O.K.

THIS Teagle socket is, in the judgment of experienced radio engineers, *the best instrument for the purpose that has ever been devised.* That's a strong statement, but the Teagle socket, when put into use, proves that it deserves just such an unqualified endorsement. When you make it a part of *your* radio equipment, you'll promptly join the army of those who are praising it without stint. It's *a better socket.*

The Teagle socket has a genuine Bakelite sub-base, with four substantial binding posts, and tempered German silver contact springs. The socket itself together with the panel bracket and table lugs, are stamped as one unit from a single piece of brass. This results in a rugged simplicity never hitherto achieved in socket construction. The Teagle socket can therefore be used with equal facility for both panel and table mounting. And the matter of appearance has not been overlooked; the metal parts are highly nickeled and polished. This socket is designed to fit detector, amplifier and transmitter tubes. In common with the other carefully-worked-out items in the Teagle line, you can absolutely bank on this radio instrument giving you efficient service and gratifying results. And last but not least, *the price is less.*

Ask your dealer, or send direct to us, for No. T-101 V. T. Socket (shipping weight 1 lb.). Price **75c**

The Newman-Stern Co

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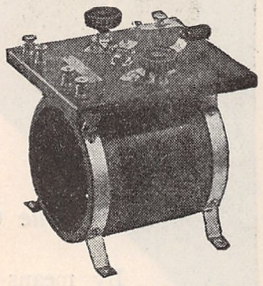

Teagle Receiving Set

A high-grade crystal receiver. Splendid design.

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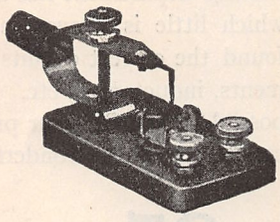
No. T-107, with "Red Head" 'phones. Price.. **16.00**



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Fully adjustable. A *better* detector.

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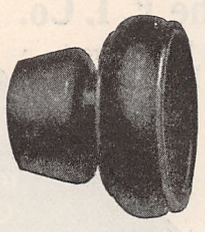

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Converts phonograph into loud speaker. Fits all standard receivers and phonographs.

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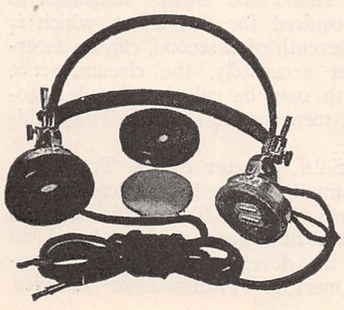
N-S "Red Head" Radio Receivers

These 3,000-ohm receivers are truly "a triumph in radio receiver design." They possess ruggedness and beauty of appearance, combined with that most important of all features—extraordinary sensitiveness. At the new record-low 1922 price of $6.50, "Red Heads" are beyond all doubt the best receiver "buy" on the market today.



No. RH Double Set with six ft. cord and military head band, Price..**$6.50**

No. RH-1 Single Receiver, 1,500 ohms, (without cord or head band), Price..... **2.50**

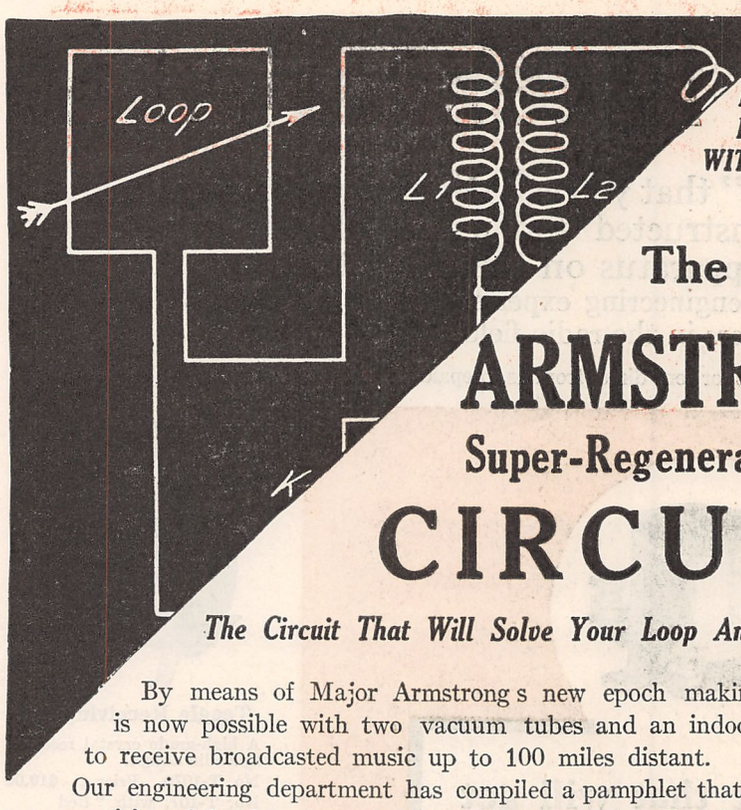
"NAA" Detector Crystals

"Known and used the world over"

These are the original tested detector minerals. There are many imitations, but they only mean "interference" with good results. The genuine "NAA" are distinguished by their tested sensitiveness—remember that!—and by the name, "J. S. Newman" on each little lithographed tin container. Demand the "real article."

NAA Galena, Silicon or Goldite, Price per crystal.....**$0.25**

Mounted, set in Wood's metal in brass cup, Price per crystal..... **.40**



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The New

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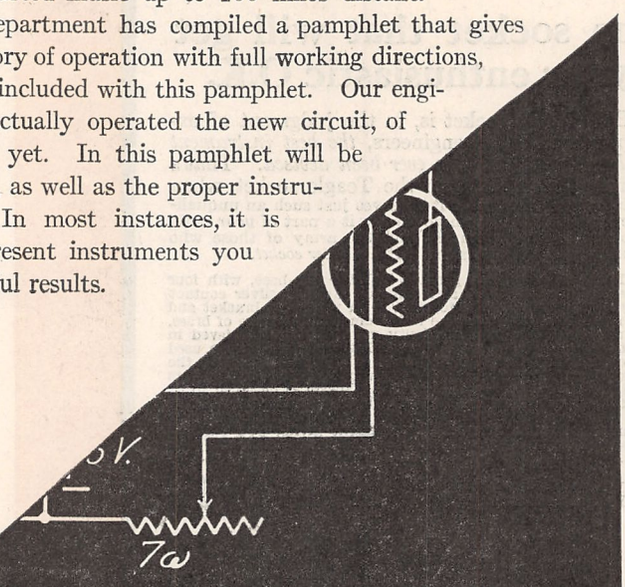
The Circuit That Will Solve Your Loop Antenna Problem

By means of Major Armstrong s new epoch making invention it is now possible with two vacuum tubes and an indoor loop antenna to receive broadcasted music up to 100 miles distant.

Our engineering department has compiled a pamphlet that gives an exposition of the theory of operation with full working directions, etc. A large blueprint is included with this pamphlet. Our engineering department has actually operated the new circuit, of which little is known as yet. In this pamphlet will be found the correct circuits, as well as the proper instruments, inductances, etc. In most instances, it is possible that with your present instruments you can achieve these wonderful results.



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next demonstrated, consisting of special alloys and possessing similar characteristics to the oxide filament, while being especially satisfactory by the absence of disturbing noises.

In accordance with a scheme first devised by Dr. Meissner, cathode tubes are, of course, used also for generating electric waves, i. e., as radio transmitters, especially for telephone purposes. Even high power stations are designed on this principle. Recent improvements in this connection, apart from a lengthened life and reduced dimensions, enable the working tension to be increased. Dr. Rukop demonstrated three new types, viz., two for 10,000 volts and 1 and 2½ kilowatts respectively, and one for 20,000 volts and 5 kilowatts. These new sending tubes afforded an apportunity of demonstrating the familiar Tesla tests, especially the radiating coil experiment, in an especially striking form with cathode tube vibrations.

Dr. Esau, director of the high power station receiver laboratory, then gave an account of his results in connection with receiver tests in South America. The use of amplifier tubes in receiving, of course, enables the huge receiving aerials formerly used to be replaced by transportable loop antennae, which have been found to work satisfactorily even over distances up to 20,000 kilometers, i. e., half the circumference of the earth. A loop area of only 0.04 square meter, under satisfactory conditions, is sufficient to obtain this effect. On account of the growing number of wireless sending stations, receivers must comply with more stringent requirements to obtain freedom from interference. In this connection the use of amplifier tubes has likewise proved of great advantage. A number of receiving tests were carried out in Argentina, which are to afford a basis for the wireless service between Berlin and Buenos Aires to be opened in the near future, when the new high power station, the construction of which was commenced about a year ago, will begin to operate. In connection with these tests an opportunity was afforded of investigating conditions in the case of stations receiving from transmitting stations situated on the opposite pole of the globe, i. e., in the vicinity of the antipodes. Just as the magnetic needle at the magnetic north pole ceases to point in a given direction, the receiver loop under such circumstances no longer shows any directive effect. Moreover, wireless signals then frequently become unreadable, though the necessary intensity is by no means wanting. These striking phenomena, here observed for the first time, were perfectly elucidated by Dr. Esau, who thus succeeded in providing a theoretical basis for ascertaining the receiver energy at the antipodes. In the neighborhood of the antipodes the ordinary loop antenna fails to work and should be replaced by a unilateral loop frame, receiving only from one direction, while the opposite direction is made inactive. The phenomena above referred to were due to the more or less considerable superposition of Morse signals, depending on the time difference of the two trains of waves arriving from opposite directions. This interference could only be avoided by receiving the waves from one direction alone.

The time is no longer distant when we shall be able not only to receive at the antipodes, but to receive signals which travel completely round the earth. Inasmuch as the time required for this effect, which is about one-seventh of a second, can be ascertained most accurately, the circumference of the earth may be calculated and trigonometrical measurements checked by this means.

Mr. K. Solff, director of the Transradio Company, finally proceeded to describe the arrangements of the Transradio Central Station. He first gave a short historical survey of the development of the Nauen-North America Transatlantic service,

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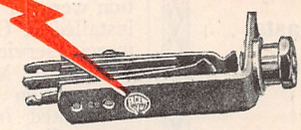

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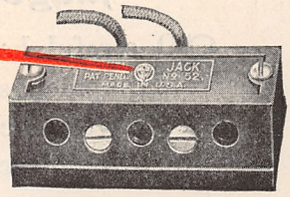

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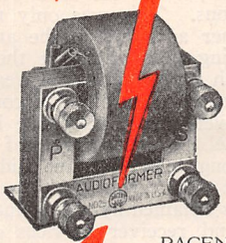
The PACENT Trademark Solves Your Radio Problems



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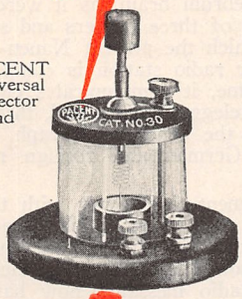

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THE PACENT UNIVERSAL PLUG is the *original* radio plug. It gives perfect contact, fits all standard jacks and is approved by all radio authorities.
Cat. No. 50.....Price, $1.25

PACENT RADIO JACKS are used as standard equipment by the largest leading radio manufacturers. This in itself is sufficient assurance that these Pacent Essentials perform perfectly.
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THE PACENT TWIN ADAPTER is a device which enables you to connect two plugs into one jack. It is the only device which meets this frequent radio need.
Cat. No. 51.....Price, $1.50

THE PACENT MULTI-JACK is a moulded unit of three jacks and enables you to connect three 'phones to a single pair of binding posts.
Cat. No. 52.....Price, $1.50

THE PACENT AUDIOFORMER meets the need for a transformer which gives perfect amplification of music and speech at all audio frequencies.
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THE PACENT UNIVERSAL DETECTOR STAND incorporates every possible modern feature for a device of this kind. It is an extreme offering of quality at the right price.
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PACENT DUO-LATERAL COILS are generally conceded the "last word in inductances." Besides being used in standard sets of wide distribution they were approved and used by Major Armstrong as important elements in his new super-regenerative circuit.
Sizes US25 to US1500

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All Kennedy Regenerative Receivers are licensed under Armstrong United States Patent No. 1,113,149.

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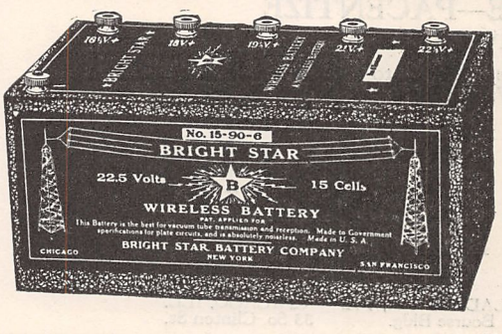

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Strong Recuperation
Binding Post Terminals

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which, as far back as at the end of 1914, as a simple alternate service with one antenna at either end, gave quite satisfactory results. This was due primarily to the fact that the two stations engaged in this service, Nauen and Sayville, were set apart for it exclusively and could accordingly avail themselves of the most suitable hours of the day for sending and receiving. When, in 1919, the U. S. Government station at Annapolis resumed communication with Nauen, only a few hours daily could be spared for this service. Full advantage had, therefore, to be taken of the limited time available by the adoption of a duplex service, i. e., by simultaneous sending and receiving in either direction. The arrangements required to obtain this duplex operation were, in the case of Nauen, temporarily installed at Geltow and a satisfactory commercial service was established. The private station at Marion, owned by the Radio Corporation of America, was eventually substituted for the Government station at Annapolis.

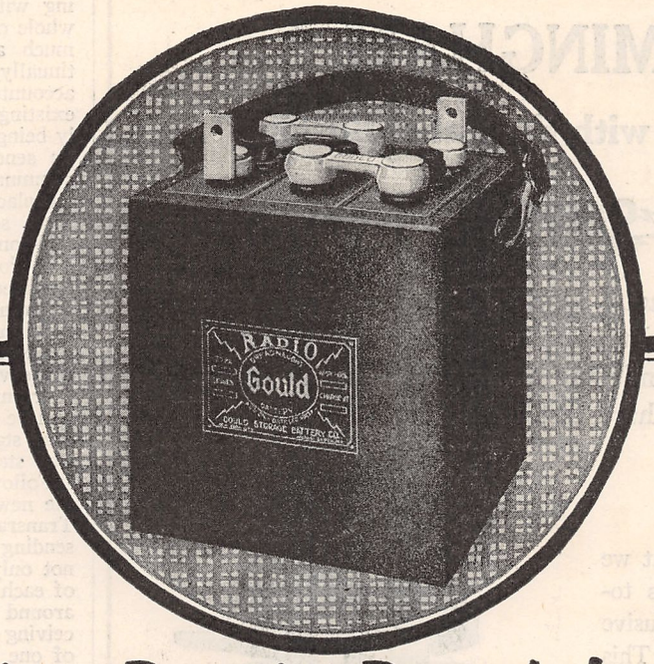
The continually increasing radio business on this line soon called for another improvement of the duplex service, which was effected by connecting the sending and receiving stations at the German end not only by telephone, as formerly, but by distant control. This allowed the Nauen transmitter to be controlled from the Geltow receiving station. While this was an undoubted progress, it was far from affording ideal conditions. This was only made possible by further advances in the amplifying and selecting possibilities at the receiving end, which enabled even the weakest received signals to be transmitted a considerable distance over simple telephone lines. Inasmuch as the distant control of the sender over a long telegraph line did not raise any difficult engineering problems, the ideal solution was obtained by a combination of the sender and receiver services at a central station situated in the immediate proximity of the main telegraph office. This is how the idea of the present Transradio Central Station originated. It constitutes the cerebrum brain, as it were, of the combination of three senders and seven receivers, of which the present Nauen-Geltow high power radio station is composed. At the same time, it communicates closely with the main telegraph office and, through this, with both the general telegraph wire and with the German and foreign radio systems.

This arrangement does away with those causes of delay and errors which were unavoidably connected with the re-telegraphing between the main telegraph office, Geltow and Nauen. Radio messages now handed in at the Transradio Transatlantic Counter of the Berlin Post Office No. 24 are, in a twinkle, by pneumatic post, transferred to the main telegraph office situated in the same building as the counter, together with the distant-control radio station. The message, therefore, goes immediately to the Morse keys actuating the Nauen senders. Each signal, in a fraction of a second, reaches the New York central station of the Radio Corporation of America, which is arranged in a similar manner.

German Transatlantic messages coming from places outside of Berlin, as well as those coming from other parts of Europe, are, if destined for transmission by "Transradio," first transmitted by wireless to the Berlin main telegraph office, in order thereafter to be handled in the same way as those originating from Berlin.

The advantages of this centralized service are clearly seen in the continually growing European and Transatlantic radio business dealt with from Berlin. Nauen and its sister station Eilvese are, in the Berlin-America service, dealing with about one-half million words per month, while the number of words dealt with from Nauen on

Gould Radio "A" Batteries are used by the various Radio Branches of the U. S. Government. Built for dependable, continuous service. Made in sizes from 60 A. H. to 160 A. H.



Retail Prices
$17 to $29
(f. o. b. factory)

A Fine Radio Receiving Set Deserves these Quality Batteries

THESE newest additions to a Famous Battery Family—the Gould "A" and "B" Radio Storage Batteries—are designed and built for Radio work by a manufacturer with over a generation of experience in making railroad, submarine, central station and automobile batteries.

Gould Radio Batteries are built by the same men who build the Gould Automobile Battery, known for "Longest Life by Owners' Records." They are equipped with the same rugged Dreadnaught Plates and Armored Separators. No finer Batteries can be produced.

Gould Radio "B" Batteries are exceptionally compact owing to the unique insulating features of their design—require no more shelf space than a dry battery—provide a steady, continuous, noiseless service—are easily recharged and if given proper care will last many years.

On sale by Radio Dealers and over 3000 Gould Service Stations

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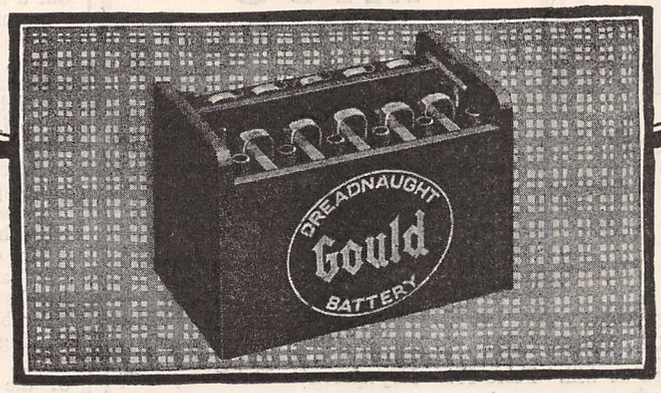

Patents Applied For

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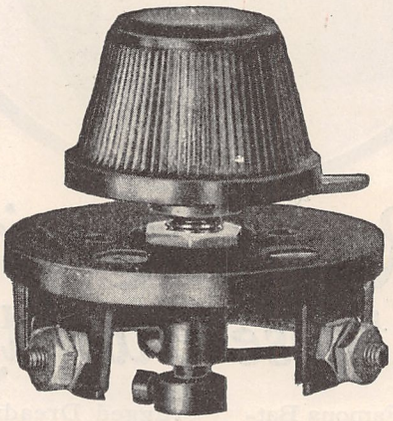
"The Rheostat with the Panel Bushing"

Merits the SORSINC Guarantee

THE Ship Owners Radio Service, Inc., has for some time been looking over and testing filament rheostats in order to find one which would permit fine adjustments and at the same time stand up under the hard test of service.

In the Framingham Rheostat we have found these advantages together with a unique and exclusive feature—the panel bushing. This bushing simplifies the mounting of the Framingham, and once set in place gives it extreme rigidity.

The Framingham is a rheostat we are proud to guarantee as to service and dependability.



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For Table or Panel Mounting

The Sign of the Reliable Radio Store. Watch for it.

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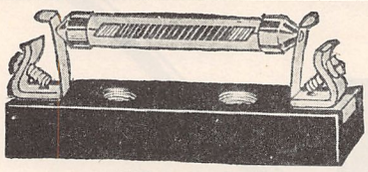

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GRID LEAKS AND MOUNTINGS

Resistance Ranges from .05 Megohms to 5 Megohms. Carefully Calibrated and Accuracy Guaranteed

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MICO

Wires for Radio

COTTON AND ENAMEL WIRE ON ¼-½-1 LB. SPOOLS

Antenna Wire Ground Wire

BULB LIGHTNING ARRESTER

Specialists 40 Enamel

Metals & Insulation Co. of America
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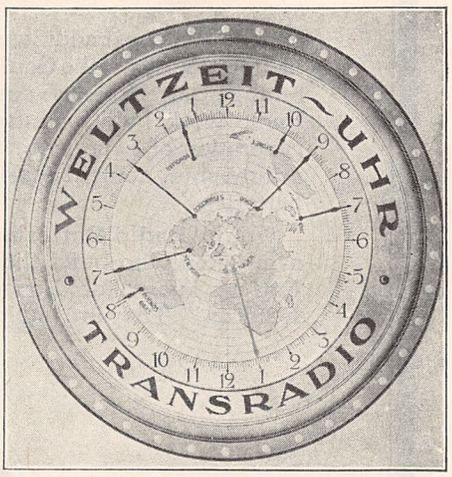
Get a Handy Binder for your RADIO NEWS. Holds and preserves twelve issues, each of which can be inserted or removed at will. Price 65c. Experimenter Pub. Co., Inc., Book Dept., 53 Park Place, New York.

the four European lines, is about the same. In fact, high power radio stations are dealing with a considerable percentage of the whole of the German foreign service. Inasmuch as this business is increasing continually, the growing requirements must be accounted for by a provident extension of existing radio stations. Nauen is accordingly being submitted to an extension by which its sending output will be trebled and its communicating possibilities multiplied. In the place of the present three antennae and three senders, four antennae, each with a self-contained, high frequency generator set, i. e., four independent sending stations, are provided, which, either simultaneously or in different combinations, will account for all requirements of radio communication with the North as well as the South of America. Moreover, by "tapping" the large senders, four small senders for the European service will be provided. In a similar manner, Eilvese station is to be converted into a two-way station.

Following these addresses, an inspection of the new and interesting installations of the Transradio Central Station was made. The sending and receiving services are combined not only in the same room, but, in the case of each pair of corresponding radio stations, around the same table, the sending and receiving telegraphists being seated in front of one another. There is a "Europe Hall" and an "America Hall." In case of doubt as to the exact wording of a message, the receiving telegraphist simply stops his apparatus and asks his partner to request a repeat. An answer is immediately received from the other end. Some of the radio business is still dealt with by hand, while



The World Time Clock at the German Radio Central Which Shows the Time at All Parts of the World.

automatic high-speed operation is resorted to on an ever increasing scale. The maximum rate, in the former case, is 20 words, and in the latter, 130 words per minute. In the case of automatic operation, the message is transcribed on a special typewriter, turning out a punched tape which, on being run through a Siemens and Halske high-speed telegraph, automatically sends out a sequence of dots and dashes over the transmission line to the Nauen sending station. From there, in the form of ether waves, they are automatically radiated into space and, at the New York end, received by high-speed Morse recorders at the premises of the Radio Corporation of America. The only difference in the installations of the New York central station is that there is no special punching hall there, the punching operator being seated at the same table with the sending and receiving telegraphists.

An especially interesting feature is the installation in the two halls of "World Time Clocks" of a new system on which the considerable differences of time between the sending and receiving stations are recorded direct, thus enabling the most suitable hours of the day in each case to be chosen for radio transmission.

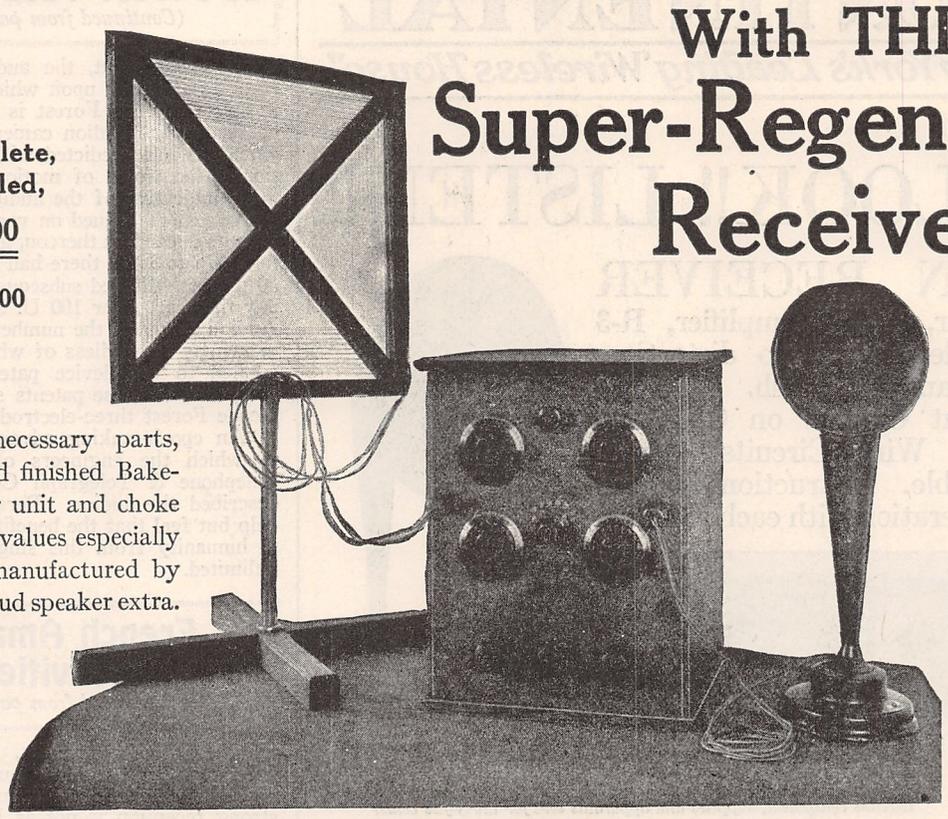
Receive Broadcasts on a Loop With THIS Super-Regenerative Receiver

Price complete, unassembled,

$75.00

No. RG600

Includes all necessary parts, with drilled and finished Bakelite panel, filter unit and choke coils of correct values especially designed and manufactured by us. Loop and loud speaker extra.



Price, completely assembled in attractive solid mahogany cabinet, ready for wiring,

$95.00

No. RG601

Harkness Booklet free with each set. Loop and loud speaker not included.

Described by Kenneth Harkness in his new booklet on

The Construction of Super-Regenerative Receivers

Approved by the New York Evening Mail Radio Laboratory and Leading Radio Experts throughout the Country

Literary Digest says: "full instructions are given by Mr. Harkness for the home construction of various Super-Regenerative circuits."

N. Y. Evening Mail says: "these sets have been examined by a representative of the *Evening Mail,* and bear out exactly the statements made in the booklet."

Washington Herald says: "The booklet is authoritative, fully illustrated and well arranged. It. . . .is comprehensible by the radio expert and the experimental novice as well."

Atlanta Journal says: "One of the most complete sources of information. . . . in which Kenneth Harkness gives a detailed description of the Armstrong Circuit."

This new and improved edition of the popular Harkness booklet describes the construction and operation of two different Super-Regenerative Receivers, with full and detailed mechanical drawings, wiring diagrams and numerous photographs. It also describes the theory of super-regeneration in detail, with four diagrams.

Price of Booklet 50 Cents
from your own dealer or direct

Radio Frequency Specialists

The Radio Guild, Inc.

256 West Thirty-fourth Street, New York City

Designers and Manufacturers of the "Vox Humana" the Receiver with the Living Voice

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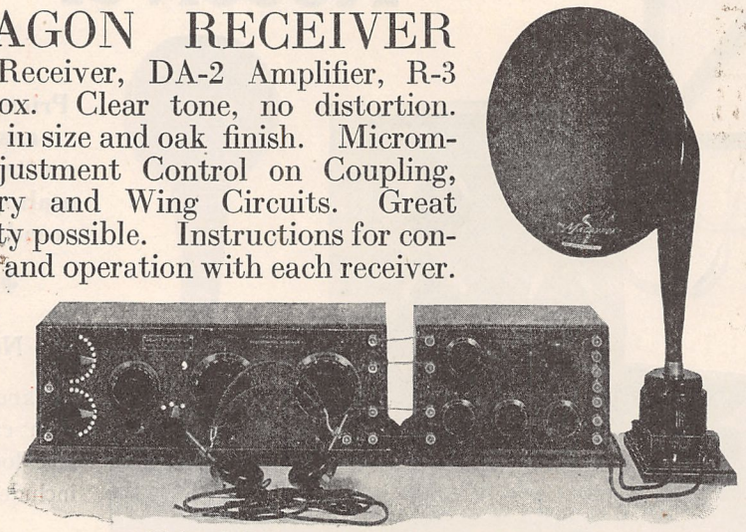
"New York's Leading Wireless House"

THE SYMBOL OF SERVICE

STOP! LOOK!! LISTEN!!!

PARAGON RECEIVER

RA-10 Receiver, DA-2 Amplifier, R-3 Magnavox. Clear tone, no distortion. Uniform in size and oak finish. Micrometer Adjustment Control on Coupling, Secondary and Wing Circuits. Great selectivity possible. Instructions for connections and operation with each receiver.



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With Aerial, Tubes and Batteries

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"Modern Radio"—a new two hundred and eight page catalog of our wireless equipment, supplies and apparatus sent for thirty-five cents.

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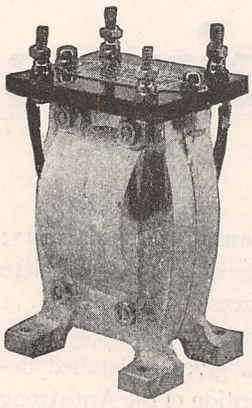
SIX *and* FIFTEEN WARREN STREET, NEW YORK, U. S. A.



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PERFECTION PRODUCTS

Seco Audio-frequency Transformer is a highest grade instrument, heavily shielded in special Aluminum Alloy Case against eddy currents. Noiseless. Highest efficiency.

Lowest "B" battery power required
SECO type A.F. 500 (enclosed). List Price $6.50
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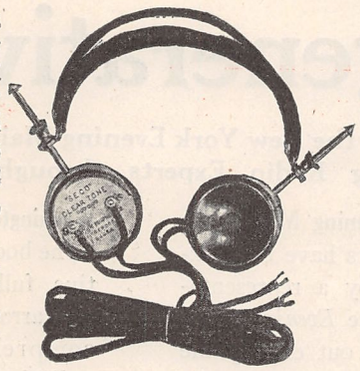
SECO 2200 Ohm HEAD SET

A receiver set designed and built to obtain maximum clarity and volume of tone without sacrifice of either quality. The result is a sweeter toned receiver than other makes.
SECO 2200 ohm Head Set. List Pr.$8.00
Prices postpaid U. S. and Canada.

Scientific Equipment Co.
Ridgewood, N. J.



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Our latest BULLETINS show every new practical development in Radio. Our New Building is most up-to-date RADIO plant and store in the West.

REYNOLDS RADIO

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Get a Handy Binder for your RADIO NEWS. Holds and preserves twelve issues, each of which can be inserted or removed at will. Price 65c. Experimenter Pub. Co., Inc., Book Dept., 53 Park Place, New York.

The True Story of the de Forest Vacuum Tube

(*Continued from page 633*)

radio development, the audion is the keystone to the arch upon which the phonofilm is built. Dr. de Forest is now engaged in perfecting the audion camera and projector which he has predicted will shortly revolutionize the world of motion picture art.

As indicative of the audion art, the number of patents issued on various devices and circuits dependent thereon, gives a pretty fair key. Up to 1912, there had been issued over 20 patents, all filed subsequent to 1904. Today there are over 100 U. S. patents on the Audion Art and the number is very rapidly growing. Regardless of what name may be applied to the device patented, practically every one of these patents since 1906 shows the de Forest three-electrode bulb.

"An epoch-making advance," is the way in which the engineers of the American Telephone & Telegraph Company recently described the audion. Personally, I cannot help but feel that the benefits that will come to humanity from this single invention are unlimited.

French Amateur Activities

(*Continued from page 640*)

quite satisfactory results, being nearly as sensitive as the regular audions on weak signals, although the sound produced for strong reception is not as loud as with the usual type. However, this does not matter in most cases, except when it is required to demonstrate a loud speaker, as strong signals are often too loud to be comfortable when the phones are worn.

A last word which, although not of wireless, may interest amateur photographers: The part of the room in which my wireless set is situated is very dark and I was afraid that it would not be possible to get a good photograph of it. The two accompanying pictures were taken by a friend of mine, Mr. Maurice Clochard, who is a keen amateur photographer; he took special precautions to get a satisfactory picture. First he placed a white reflector which was hung from the ceiling at the right of the camera in order to lighten the shadows on the table, also a big mirror was placed so as to give a luminous reflex on the darkest part of the set. It was about 10 A. M. when the photo was taken; the sun was then fairly bright outdoors, but the muslin across the window softened the light. The speed number of the plates used was 570 H & D, and the aperture chosen was F32; the exposure was 20 seconds; another attempt which was made with F16 and 10 seconds exposure gave much less satisfactory results.

One Way or Another

(*Continued from page 643*)

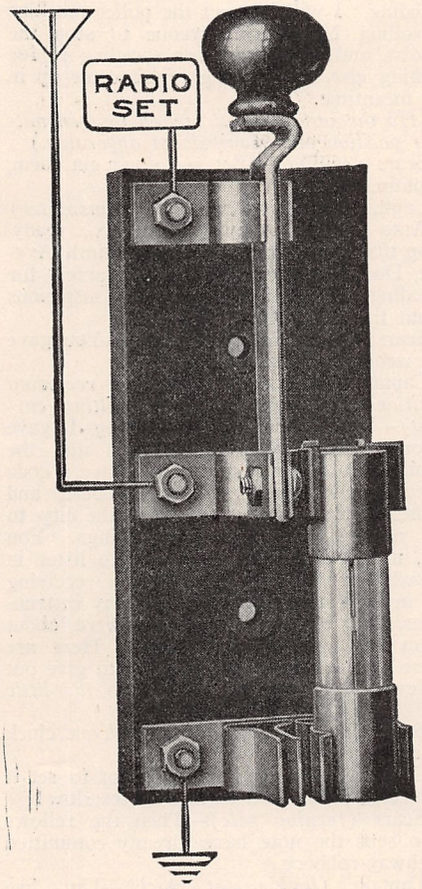
(*The telephone bell rings. The Captain removes the head-set and goes to answer phone on right side of room.*)

Captain (*lifting receiver to ear and speaking into transmitter*)—Hello . . . (*pauses*) . . . Yes . . . (*pauses*) . . . I'll have him stopped; we must take no chances. Repeat that license number again. (*He takes pencil from pocket of uniform and writes on pad of paper.*) That's good Marsh, good-night.

(*The Captain puts receiver on hook and crosses room. He seats himself before the radio apparatus and puts on the head-set.*)

Sears—Well, you didn't make a reply to what I said last.

DOUBLE PROTECTION



Cat. No. 602
Price $3.50

This is the Barkelew Lightning Arrester Switch, the most compact and efficient protective device on the Radio market.

The Barkelew Radio Lightning Arrester Switch

Continuous Vacuum Tube Arrester Protection with a Positive Ground When Desired

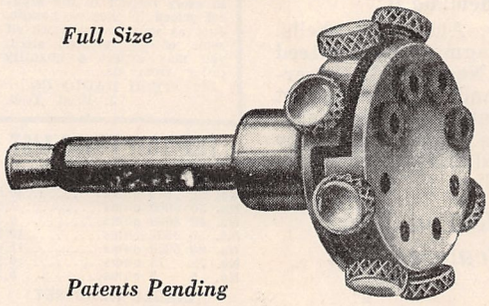
(Approved and Listed by The Underwriters Laboratories)
Patents Pending

Two separate devices have been developed for protecting antenna circuits from lightning—a Radio Ground Switch and a Vacuum Tube Arrester. *Each has advantages and disadvantages.* We have combined the two on one base, multiplying efficiency and protection, and overcoming the disadvantages of using either type by itself.

Here then you have one compact Lightning Protection device which insures to you the *combined merit* of the Radio Ground Switch and the Vacuum Tube Arrester. Send for *Bulletin No. 30,* telling of the merits and disadvantages of both types, and how by combining the two on one base we have solved the lightning protection problem.

The Barkelew Four-Phone Plug

Full Size



Patents Pending

Cat. No. 614—Price $1.50

Let the family "listen in" with this small, simple and inexpensive Phone Plug which permits the use of four phones or less, on any set using a telephone jack. There is ample room for all the phone tips and they are easily adjusted without removing the plug. *Send for Bulletin No. 29.*

To Radio Distributors and Dealers

Trade Discounts to Radio Distributors and Dealers who have established standing or can prove their status.

Local distribution is through Dealers where available.

Ask for our new Window Display Card designed to boost sales and featuring our Four-Phone Plug.

The Barkelew Electric Manufacturing Co.

15 S. Clinton St., Chicago
75 Fremont St., San Francisco

MIDDLETOWN, OHIO

7-9 W. Canal St., Pittsburgh
365 W. 23d St., New York

BARKELEW

What Part of the $300 in Prizes Do You Want to Win?

How would you like to receive $100 in gold in return for spending an hour or so in pleasure—helpful, profitable pleasure? We believe RICO receivers are the finest on the market. We know they are one of the fastest selling. That's why we're willing to spend a few hundred dollars in order that you may learn the superiorities of RICO Telephones.

GOLD!

Six Prizes, $300:

First Prize	$100 in Gold
Second Prize	75 in Gold
Third Prize	50 in Gold
Fourth, Fifth and Sixth Prizes (each)	25 in Gold

Hurry! The Contest Closes October 20th.

But there is still time for you to swoop in one of the six wonderful prizes. The idea of the contest is very simple. We are going to give prizes to those who originate some new idea or a new stunt with RICO Receivers. In order to make plain what we want, we have shown four examples on a circular which we will gladly send you with our compliments.

Why You Will Find RICO The Best

RICO marks a new advance in telephone receivers. These receivers are built on a radically different plan than all other receivers. The pull on the diaphragm is where it should be—in the mathematical center of the diaphragm.

Other Outstanding Mechanical Features make RICO the Choice of experts who know the best and demand it:

Lightness, Stability, Aluminum shells. Non-rusting diaphragms. Guaranteed tungsten magnets. Neat, black mercerized cord. Headband adjustable not only to every size head, but the two bands are adjustable as well; the only headband made in this manner. Sanitary soft rubber covering that can be washed and will not catch the hair—especially appreciated by ladies.

What Part of the $300 Will You Win? Send TODAY For Full Particulars FREE

RADIO INDUSTRIES CORPORATION

131 Duane Street New York City

RICO

TRI-POLE DOUBLE HEAD PHONES

TESTIMONIALS

CAPITAL RADIO COMPANY,
2041 K Street, Lincoln, Neb.

Gentlemen:—In regard to your **RICO** tri-pole 'phones, we wish to state that we have tested them out in our laboratory and find them equal in sensitiveness, and in several instances far **superior** to 'phones selling at higher prices. We also wish to commend you on the construction of the headband, which is exceedingly comfortable.

CAPITAL RADIO COMPANY,
Paul C. Rohwer, F. Bradden.

PHILIPSBURG FOUNDRY & MACHINERY COMPANY,
Philipsburg, Penna.

Gentlemen: — Relative to the **RICO** Tri-pole 'phone, which we received from you some time ago, please be advised as follows: We have found this 'phone **very sensitive**, especially in conjunction with its use with our sensitive Receiving apparatus, the Bakigil Grand, of our own manufacture.

R. I. GILLAND,
General Manager.

TESH RADIO COMPANY,
High Point, N. C.

Gentlemen:—We have tried out the **RICO** Tri - pole 'phone which we received from you; **we find it equal in every respect to the highest priced** 'phones we handle. Just as soon as we work off some of our present stock, you may expect a quantity order from us.

TESH RADIO CO.,
J. Fred. Tesh.

THE LOW PRICE LIST

DOUBLE HEAD SET

No. 20	2000	ohms	$6.50
No. 30	3000	ohms	7.50
No. 40	4000	ohms	9.50
No. 50	5000	ohms	12.50
No. 60	6000	ohms	15.00
No. 75	75	ohms	6.50
No. 5	5	ohms	6.50

SINGLE HEAD SET

No. 10	1000	ohms	4.00
No. 15	1500	ohms	4.50

RECEIVER ONLY

No. 2	1000	ohms	2.50
No.075	75	ohms	1.00
No. 3	1500	ohms	3.00
No. 05	5	ohms	2.50

States Radio Corporation

STATES RADIO CORPORATION CHICAGO

501 So. Jefferson St.
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Manufacturers of
High Grade Equipment

Immediate Delivery

Radio Frequency Detector, and 2 Stage Amplifier.

In attractive mahogany cases, simple, reliable, tunes to all broadcasting, giving clear reproduction—local and long range. No wiring to do.

Ask for STATES RADIO and get the best.

Everybody Wants a Radio Research Lapel Button

Worn by radio fans from coast to coast who have built their own sets.

Gold plated 50c; Solid 14k Gold $5.00.

Artistic, high grade. No enamel to chip off.

By mail postpaid if your dealer is out of stock.

RADIO RESEARCH GUILD
9-15 Clinton St., Newark, N. J.

Mounted 12 on a display card. Jobbers and dealers write for discounts. EASY SALES—GOOD PROFITS.

MONEY for You Add to your Salary—Make extra Pin Money. Start a lucrative business of your own.

Spend an hour each day taking subscriptions for the "Radio News." We'll pay you well and you'll enjoy the work. Write for full particulars. Circulation Dept., RADIO NEWS, 53 Park Place, N. Y. C.

Captain—No, but I will show you how the radio set works. A mounted policeman just phoned me that a speeding automobile passed him, disregarding his hand signal to stop. The machine is going out Nineteenth Avenue. There have been quite a few robberies in that district lately, and the man driving the automobile is going fast enough to be suspected of something worse than speeding. I will instruct the police machine patrolling Nineteenth Avenue to stop the autoist, and arrest him for speeding if for nothing else. Something might come up in the meantime.

(*He throws in aerial switch to transmitting position and manipulates apparatus.*)

Sears (*smiling*)—Bet you don't get them, Captain.

Captain (*speaking into hand transmitter*)—Auto two, auto two, auto two, ready. Stop machine going out Twenty-ninth Avenue, Dodge number 612122A, and arrest for speeding if there is nothing more suspicious about the men. Good luck.

Sears (*somewhat ill at ease*)—You gave the wrong street, Captain.

Captain (*throwing switch to receiving position and turning off transmitting current*)—That's not the only thing I gave wrong. The name of the car and the number are also incorrect. We have a code for all automobiles, license numbers, and names of the different streets in the city, to say nothing of a few other things. You see, it will do no one any good to listen in on what we say. Bandits with a receiving set in their machine might get my instructions, but if the instructions were about them they would never know. Here are some of the code books; I have to give out a few tomorrow. (*He points to the little red books on the receiving cabinet.*)

Sears (*looking at the clock*)—Your clock is right?

Captain—No, the janitor forgot to set it correctly, it is about eight minutes slow!

Sears (*turning pale*)—Then the fellows who sent the note have already committed highway-robbery.

Captain (*looking at clock*)—Um, five minutes have passed, if they pulled it off the time they said in the note. The correct time is now 9:20 o'clock. Maybe they were a few minutes late. A report should come in any moment now.

(*The telephone bell rings. The Captain removes head-set and goes to answer phone.*)

Sears (*very pale*)—Maybe—

Captain (*ready to lift receiver*)—Yes, maybe your friends were a little late and this is the report.

(*The Captain takes the receiver from hook.*)

(*Sears quickly takes one of the little red code books and slips it into his inside coat pocket while the Captain's back is turned.*)

Sears (*grasping wireless hand transmitter with one hand and with the other throwing in aerial switch for sending*)—Boys, police have secret code. Make your getaway the best way you can and disregard all instructions that come from this station.

Captain (*into line telephone transmitter*)—Wait a few moments, please. (*He laughs.*) I could have shot you, Sears, before you finished the first three words, but, you forgot in your excitement that it takes electricity to transmit the voice. Next time don't forget the current. Take a look at this.

(*The Captain draws a revolver from under his coat. He stands with mouth to side of line telephone while one eye watches Sears.*)

Sears (*sitting down*)—I'll learn all about these wireless sets yet.

Captain (*speaking into transmitter*)—Hello... (*pauses*)... What, highwaymen have robbed an autoist on Judah Street?... (*pauses*)... At 9:15 o'clock; they headed out Nineteenth Avenue? Give that number again... (*pauses*)... Thank you, we'll get

Broadcasting a Message of Radio Reliability

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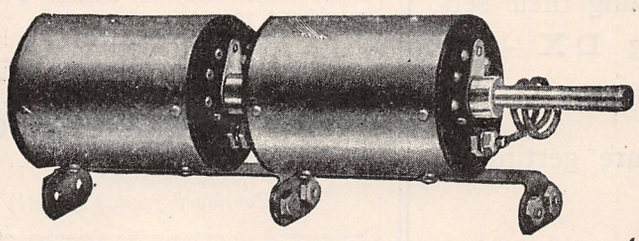
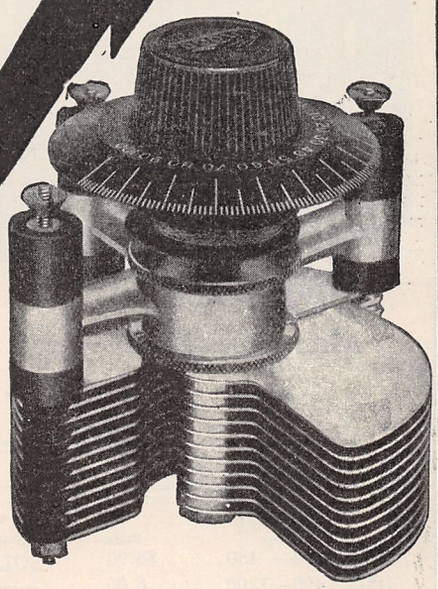
TRADE MARK REG. U. S. PAT. OFF.

Buy by This Name and You Buy Right

COTO COIL CO. is not a mushroom growth in the Radio Field. We were winding electrical coils long before the radio boom. We are here to stay. Our products are right to hold their own in any comparison for quality. Electrically correct and mechanically accurate. Even the Cotoco Dial is a better product—practically unbreakable, with metal insert to make it run true.



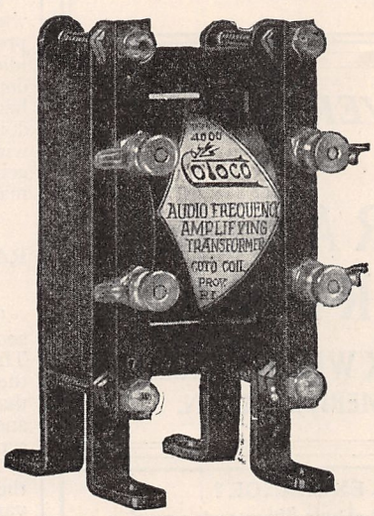


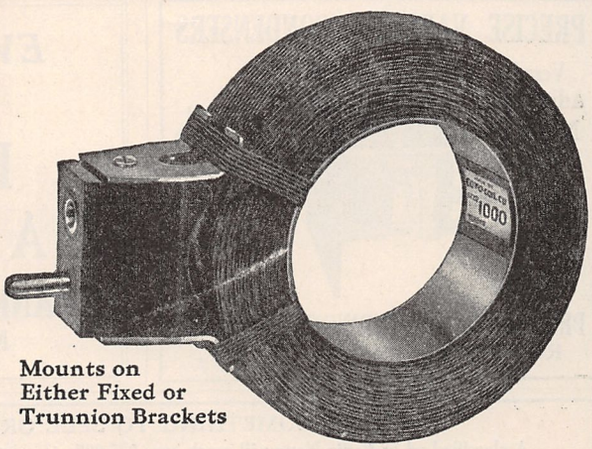
Cotoco Amplifying Transformer for Radio Frequency Makes Loop Aerials Practical

The advantages of all-in-the-room Loop Aerials are obvious. Greater selectivity, of course. Users report twelve and more stations received one night. Now ample range is secured. You will want our Connection Diagrams for two stages (as illustrated), or three stages of Radio Frequency Amplification.

Above, the COTOCO VARIABLE AIR CONDENSER, scientifically correct for minimum of electrical losses. A fine machine product that is as superior as it looks. At left, below, the COTOCO AMPLIFYING TRANSFORMER FOR AUDIO FREQUENCY. Allows you to forget distortion. Whether through head phones or loud speaker, music or speech comes clear and true. At right, below, the COTOCO HONEYCOMB COIL, yet to find its equal as a compact, neat and remarkably efficient inductance unit.

Scientifically Correct—Mechanically Accurate





Mounts on Either Fixed or Trunnion Brackets

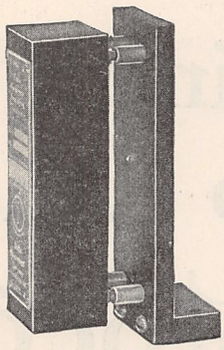
Send Us Your Dealer's Name

if he does not carry Cotoco Products. We will mail you FREE Connection Diagrams for Loop Aerial set and see that he can supply you.

COTO-COIL CO.
87 WILLARD AVE.
PROVIDENCE, R. I.

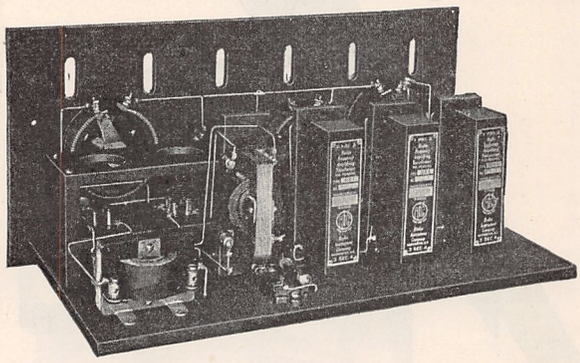
DX —RADIO— FREQUENCY

Amplifying Transformers are a Radical Departure in R F Transformer Design



Patents Pending

Nation-wide tests have proven beyond a doubt the superior qualities of the DX Transformers



Manufacturers who demand the highest quality product obtainable are standardizing their sets, using DX - RF transformer.

Make comparative tests to prove you are getting THE BEST

Send for Literature

	Wave length Range	Price
DX-1	170— 450	$8.00
DX-S	400—1200	8.00
DX-2	900—3000	8.00
Standard Plug Mounting		1.00

DX RADIO FREQUENCY TRANSFORMERS SOLD THROUGH RELIABLE DEALERS AND JOBBERS. Write for details.

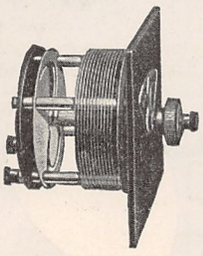
It PAYS to carry the BEST.

RADIO INSTRUMENT COMPANY, INC.
WASHINGTON, D. C.

(If your dealer does not have DX RADIO FREQUENCY TRANSFORMERS write us.)

PRECISE VARIABLE CONDENSERS

Vernier Adjustment
Maximum Efficiency
.0002 Mfd.
.0005 "
.0012 "
Capacity



Model No. 265 Of Interest to Dealers

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ROCHESTER, - - N. Y.

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HAVE YOU SOMETHING TO SELL OR EXCHANGE?
A classified ad in Radio News will reach over 235,000 at a cost of only fifteen cents a word

them. (*The Captain puts receiver on hook and crosses over to wireless apparatus.*) Yes, Sears, we'll get them, your pals!

Sears (*lighting a cigar*)—Interesting evening I had with you, Captain. Guess I'll be going now. (*He rises and walks to corridor door.*) Good-bye till we meet again.

(*Exit Sears.*)

(*The Captain pushes a button on the table. He then adjusts the wireless telephone transmitter and thrusts switch to sending position. He takes up the wireless hand transmitter, while he looks expectantly at the corridor door.*)

Captain (*into wireless hand transmitter*)—Police Captain Brady speaking. All police automobiles be on watch for Dodge car license number 612122A. Stop them and arrest all in machine.

(*There are sounds of scuffling outside, in the corridor. It continues for a few seconds. Enter Sears, handcuffed, with two detectives, one on each arm.*)

Sears (*angrily*)—What is the meaning of all this? I have nothing to do with the auto-bandits. You have nothing on me. What is the charge?

Captain (*to detectives*)—Search him. I believe he stole a little red book from the top of the receiving cabinet.

(*Detectives search Sears and find code book in his inside coat pocket.*)

Captain—Do you know the charge now, Sears? One way or another I knew I would get you.

(CURTAIN.)

The Newspaper Radio Editor

(*Continued from page* 644)

the page now bursts forth in a blaze of half-tone glory. Listening to sweet music while fishing, bathing, swimming, eating, drinking, playing ball, walking, riding, standing, sitting and even sleeping, is the motif of nine-tenths of them; the rest, as has been said, are largely—er, well, look at your OWN radio page next Sunday!

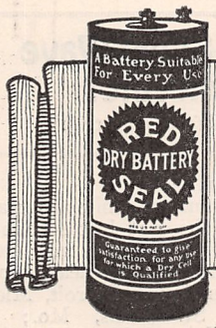
This is bad enough, but about this time the press agents and "publicity men" start in. The Radio Editor is given permission to publish long articles on what a "wiz" a certain engineer employed by a big radio company is; he is offered, "for immediate release," exciting articles on the construction of a certain radio storage battery. The only press agent stunt that is pulled that makes a real hit with him is that of the publishing houses that send him radio books with requests for reviews. He keeps the books.

The newspaper radio page is going somewhere very fast. It is now about one-fourth program, one-fourth drivel, one-fourth idiotic pictures, and the rest press agent dope. Which is the least interesting, it is hard to determine, but the radio editor is doing his best, and is working hard—next winter, he has been promised, he will receive three dollars a week more. That'll make eighteen.

RADIO TO LINK ISLANDS OF JAPANESE EMPIRE

Telephone communication by radio will soon be opened across the Chosen Strait. The stations at Fukuoka and Fusan contain the necessary equipment and it is expected that the shipping along the coasts of Kiushu and Chosen will take advantage of this service.

This particular installation is a unit in the Government plan for linking up the various islands of the empire by wireless telephone and telegraph.

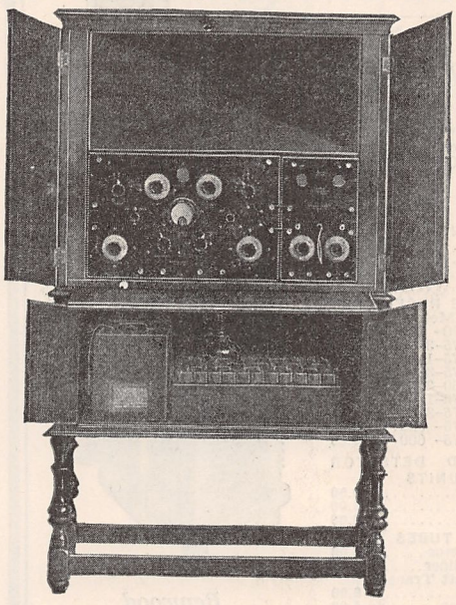


Red Seal Battery Contest

Starts Nov. 1st. Closes Nov. 15th

All Radio Sets installed FREE in the homes of the winners anywhere in the U. S. A.

Cabinet Closed



1st Prize

This cabinet type complete Radio Receiving Set is one of the finest and most complete sets on the market. It is designed and manufactured by the Colin B. Kennedy Company of San Francisco, makers of the finest type of radio receiving sets. The cabinet is walnut and stands 58 inches high—a masterpiece of cabinet making. The receiving set is regenerative, having an effective range from 175 to 25,000 meters—400 to 600 miles on "broadcasting." Contained within the cabinet are all batteries, and a most efficient loud speaker. Value complete, $725.00.

2nd Prize

It consists of the Westinghouse R. C. Receiving Set and the famous distortionless Western Electric Loud Speaker, "Tunger" Battery Charger, Storage Battery, 9 "B" Batteries, one Manhattan 3,000 ohm Headset, 3 vacuum tubes, 2 telephone plugs, and complete antenna equipment—a total value of $408.50.

3rd Prize

A complete receiving outfit made up of the well known Grebe CR No. 9 Regenerative Receiver and 2 stage amplifier, Magnavox Loud Speaker, Storage Battery, "Homcharger" Battery Charger, "B" Batteries, one Manhattan 2,000 ohm Headset, 3 vacuum tubes, 2 telephone plugs, and complete antenna equipment—a total value of $256.50.

50 Other Prizes

To 50 other contestants, whose answers the judges decide are most meritorious, will be given one of the famous Manhattan 2,000 ohm Radio Headsets. These headsets are built with the precision of a watch and have great sensitiveness and high amplifying qualities.

Win this $725.00 Radio Set FREE

Only a rich man could buy it but a poor man may win it FREE

SIMPLY obtain a free "Red Seal Battery" contest blank between November 1st and November 15th from stores that show the Window Display pictured below. Each contest blank gives full simple instructions to help you write your answer and full rules of the Contest.

"Finish the Sentence"

The prizes will be awarded for the most appropriate answers for completing *in your own way* in not more than ten words, the following sentence:

"The Red Seal Dry Battery is best
(1.) because it is the All-Purpose Battery and
(2.) because.....

Examples

Your answer may be descriptive of the Red Seal Dry Battery or it may describe some use. For example: "It never fails on land, air or sea." Another: "It never starts what it can't finish." Another: "It rings bells and buzzes buzzers."

Judges

The judges of the Contest are: Mr. Llew Soule, Editor of "Hardware Age," New York; Mr. Howard A. Lewis, Manager of "Electrical Merchandising," New York, and Mr. Joseph A. Richards, President, Joseph Richards Co., Inc., Advertising Agents, New York.

Awarding the Prizes

Prizes will be awarded to those who conform to the rules of the Contest and whose answers, in the opinion of the judges, are most appropriate. In case two or more persons submit winning answers, prizes identical in character with those offered will be given to each successful contestant.

Announcing the Winners

As soon as possible after the judges have rendered their decision, the names of the prize winning contestants will be announced in the Saturday Evening Post.

Look for this Window Display in Dealers' Windows Nov. 1 to 15. It identifies all stores that have free contest blanks.

Contest Opens Nov. 1 — Closes Midnight Nov. 15.

All answers must be written *only on contest blanks* supplied by dealers displaying Red Seal Battery Contest window display. Send as many answers as you like to:

Red Seal Battery Contest
Manhattan Electrical Supply Co., Inc.
17 Park Place
New York City, N. Y.

MANHATTAN
ELECTRICAL SUPPLY CO., INC. NEW YORK
Makers of the Famous Red Seal Dry Batteries and Manhattan Head Sets

View of Our St. Louis Retail Department

Get Ready for Fall!

This fall is going to be the greatest in the history of wireless! Dozens of new broadcasting stations are opening—and each one will cover a wider radius as soon as the summer static clears up. Radio enthusiasts will want better equipment—dealers will need better stocks—and the Benwood Co. is ready to take care of you RIGHT NOW! Order what you need TODAY!

IMMEDIATE DELIVERY

ANTENNA WIRE

	Per 100 ft.
Braided	$0.50
No. 14 solid copper	.45
No. 22 7 Strand tinned	.85

LOUD SPEAKERS

Arkay Horn	5.00
R-3 Magnavox	45.00
Western Elec.	161.00

AMPLIFYING TRANSFORMERS

Benwood Shielded	4.00
Acme Semi-Mounted	5.00
Jefferson	7.00

RHEOSTATS

Paragon	1.50
Murdock	1.00
Fada Newtype	1.00
Fada Power	1.35
Howard	1.10
Tucker	.85

TELEPHONES

Army & Navy 2500 Ohm	10.00
Federal 2200 Ohm	8.00
Frost 3000 Ohm	6.00
Frost 2000 Ohm	5.00
Murdock 3000 Ohm	6.00
Murdock 2000 Ohm	5.00
Manhattan 3000 Ohm	6.50
Manhattan 2000 Ohm	5.50
Type C Baldwins	12.00
Type E Baldwins	13.00
Type F Baldwins	14.00
Type C Baldwin units	6.00

B BATTERIES

Bright Star—22½	1.00
Burgess No. 763	2.00
Burgess 2156	3.00

V. T. SOCKETS

Benwood Panel Mount	1.00
Murdock	1.00
Socket nickel holders	1.25

DIALS

Benwood 4 in	1.50
Benwood 3¼ in	1.25
Paragon 4 in	1.75

CONDENSERS

23 Plate Signal	$3.80
43 Plate Signal	4.70
43 Plate Tucker	5.00
43 Plate Benwood	2.95

REGENERATIVE RECEIVERS

	Meter	
Grebe C R-3	170- 680	$65.00
Grebe C R-5	175-3000	80.00
Grebe C R-8	175-1000	80.00
Grebe C R-9	175-3000	130.00
DeForest MR-6	150-3000	112.00
Paragon RA-10	175-1000	69.50
Kennedy 220	175-3100	125.00
Kennedy 281	175- 620	80.00
Super-Radio	175- 600	125.00

AMPLIFIER AND DETECTOR PANEL UNITS

Benwood Dectector	9.50
Benwood Amplifier	13.00
Acme Amplifier	13.00

VACUUM TUBES

No. UV 200 Detector	5.00
No. UV 201 Amplifier	6.50
No. UV 202 5 Watt Transmitter	8.00
No. C-300 Detector	5.00
No. C-301 Amplifier	6.50
No. C-302 5 Watt Transmitter	8.00

6 VOLT "A" STORAGE BATTERIES

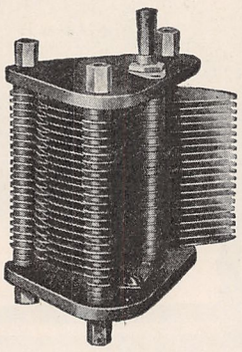
Benwood 60 Amperehour	15.00
Keco Combination Battery and Charger	35.00

VARIOMETERS

Benwood	5.00
Benwood Knock Down	4.00
Atwater Kent moulded	8.00

VARIOCOUPLERS

Benwood	4.50
Benwood Knock Down	4.00
Workrite	6.00
Atwater Kent moulded	8.00



Benwood

Variable Condenser

Note the improved stationary plate design—this condenser has the greatest capacity for overall size of any variable condenser made. Single bearing wiping contact assures positive connections. Heavy aluminum plates will not bend or buckle. Bakelite ends. 43 plate. .0011 Mfd. Each..... **$2.95**

SEND FOR CATALOG

Send 10c in stamps for the Benwood Catalog and price list, also complete catalog and price list of DeForest Radio Equipment.

DEALERS—WRITE OR WIRE!

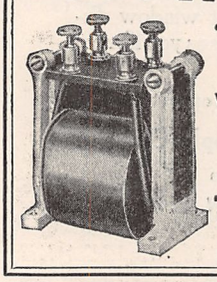
New price and discount sheets have just been issued. Write or wire for our attractive proposition on radio apparatus we manufacture. Immediate shipment.

The BENWOOD RADIO Co. INC.

"WORLD-WIDE MAIL ORDER SERVICE"

1111 OLIVE STREET ST. LOUIS, MISSOURI

Thornton *Audio Frequency Amplifying* **Transformer**



"The Transformer Supreme"

We still have territories open for Jobbers
Write for particulars

Thornton Transformer Co., Inc.
30 Church St., New York

Complete Receiving Set for $20.00

Material mounted on panel but unwired. Hook up yourself. Book of wiring diagrams furnished with each set.

Set consists of
1 Hard Rubber Panel 7 x 21"
3 " " Dials 3"
2 Variometers
1 Variocoupler
2 Inductance Switches
1 Socket
1 Rheostat
1 Comb. Grid Leak Condenser
1 Phone Jack
Wire, Tubing, Terminals, etc.

The above, combined with two-step amplifier, $35.00, unwired.

Send for price list of our complete line.

C & K RADIO MFG. CO.
299 SEVENTH ST., BROOKLYN, N. Y.

MONEY FOR YOU—Add to your salary—Make extra pin money—Start a lucrative business of your own. Spend an hour each day taking subscriptions for the Radio News. We'll pay you well and you'll enjoy the work. Write for full particulars. Circulation Dept., Radio News, 53 Park Place, New York City.

A Novel Short-Wave Regenerator

(*Continued from page* 650)

other delightful renditions.

In the middle of summer, while at Arcadia (which is close to the lead belt section of Missouri, and also surrounded by hills) with the receiver shown in Fig. 1. we heard broadcasts from Madison, Wis.; Detroit, Mich.; Memphis Tenn.; St. Louis, Mo.; Indianapolis, Ind.; Kansas City, Mo.; and Atlanta, Georgia; to say nothing of numerous distant amateurs and 600 meter stations sending in code.

The following materials were used in this receiver, and the cost of each is given. Standard apparatus of other makes than those named can no doubt be substituted with equally good results.

1 Cabinet, oak, mission finish	$5.00
1 Hard Rubber 7"x18"x3/16" (New U. S. Rubber Co.) Material for radio panels	2.00
2 *Heard Co. Variometers @ 4.35	8.70
1 ‡Heard Co. Variocoupler	4.25
1 Kellogg Vacuum Tube socket	1.00
1 Cutler-Hammer filament rheostat	1.00

*Wound with 56 turns No. 20 D. C. C. on Stator and Rotor.

‡Primary consisting of 50 turns No. 22 D. C. C. tapped every 5 turns. Rotor ball wound with 36 turns same wire.

1 No. 131 Frost Jack	.90
2 4" bakelite dials	2.50
1 3" bakelite dial	1.00
1 1½" radius switch lever	.35
11 Contact points	.55
1 Gridleak and Condenser, home-made	—.—
10*Binding-posts	1.00
1 Oz. tinfoil	.10
12 Feet spaghetti	1.20
20 Feet No. 14 aerial wire	.10
10 Feet No. 20 D. C. C. (used scrap)	—.—
5 Feet flexible lamp cord (used scrap)	.10
1 Wood board 2"x14"x½"	—.—
4 Cigar-box wood spacers 1"x3½"	—.—
1 piece brown wrapping paper	—.—
½ pint orange shellac	.15
3 dozen ½" No. 4 R. H. brass woodscrews.	
1 dozen No. 6. brass washers.	
2 only 2" No. 6 flathead woodscrews.	
8 only 1" No. 8 flathead woodscrews.	
Total screw cost about	.25
	$30.15

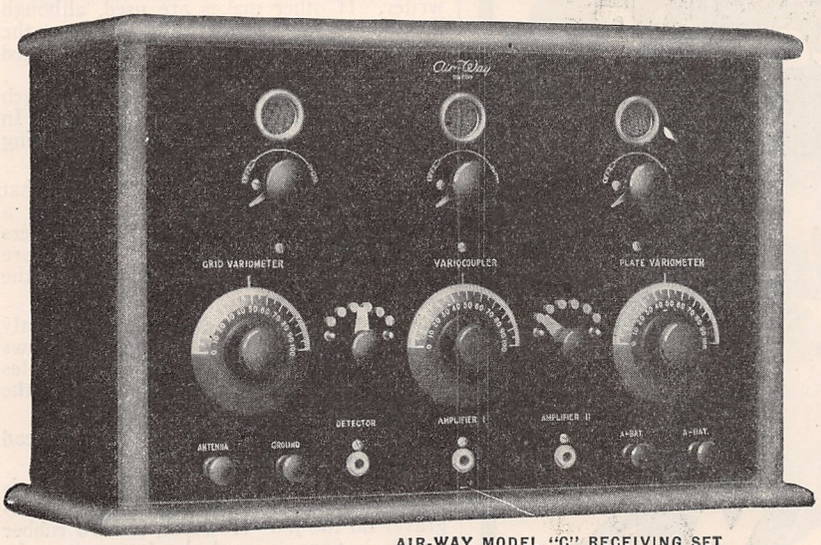
*Binding-posts have 1" No. 8-32 machine-screws with brass base-lug and thumb nuts tapped clear through. This makes it unnecessary to fit binding-posts to any special panel thickness, and leaves plenty of room for heavy interunit connections.

It is readily seen that should the builder of this set desire to economize he can make his own cabinet, wind his own variometers and variocoupler, use less expensive dials, etc. By doing this, it should be possible to build the set for about $18.

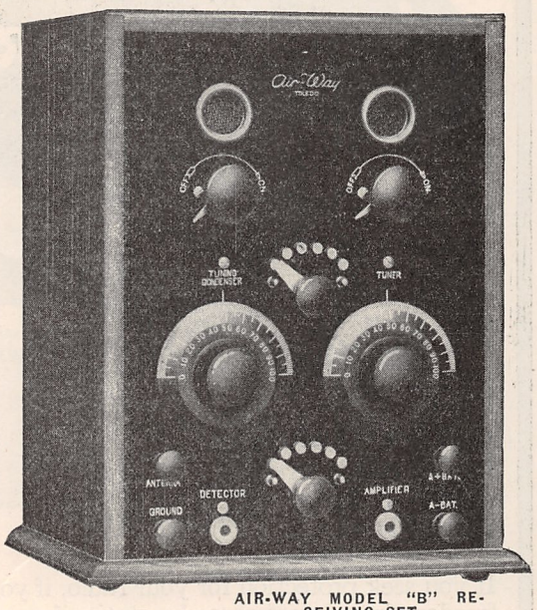
The tools necessary to construct this unit are found in nearly every amateur workshop or can be purchased at any hardware store for very little. About the only tools used by the writer were: 1 hand-drill and drills, small soldering iron, ten cents worth of solder, ten cents worth of paste, pliers, hammer and screw-driver. The entire set was constructed on the back porch of a summer home, using the dining-room table (between meals) for a work bench.

We will now describe the assembly, step by step.

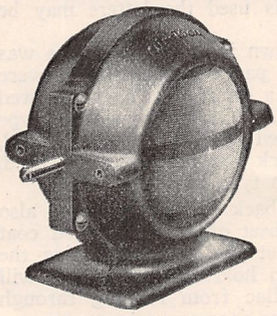
Each Instrument Guaranteed



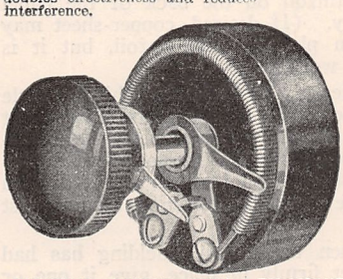
AIR-WAY MODEL "C" RECEIVING SET
Here is a sound, practical set with detector and two stage amplification. It is remarkable for its long-range reception and its fineness of tuning.



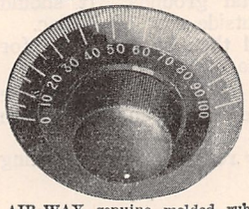
AIR-WAY MODEL "B" RECEIVING SET
This set contains so many outstanding features that radio enthusiasts have wondered at the range and accuracy of reproduction. Detector and one stage amplifier with typical "AIR-WAY" fineness of workmanship.



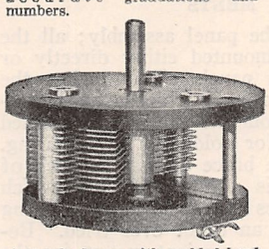
AIR-WAY MOULDED VARIOMETER
A combination of the finest known insulating material with precise assembly and accurate winding—careful AIR-WAY manufacture doubles effectiveness and reduces interference.



AIR-WAY GREEN SEAL FILAMENT RHEOSTAT
A compact Rheostat wound with non-corrosive resistance wire over a substantial insulating ring. Trim, workmanlike, effective and durable.



AIR-WAY genuine molded rubber composition with neat white accurate graduations and numbers.



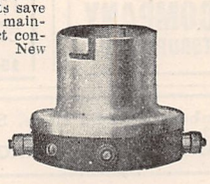
A sturdy frame with molded hard rubber endplates; uniformly mounted to assure maintained accuracy.

Air-Way
GREEN SEAL
RADIO EQUIPMENT

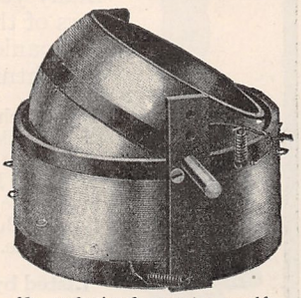
The aim of the Air-Way engineers and the policy of the Air-Way Corporation are united in the production of Radio equipment which bears the unmistakable imprint of intelligent design, expert craftsmanship, and genuine quality throughout. In the Air-Way factory there is no compromise between quality and cost. Scientifically organized production by men skilled in volume manufacture of fine electric instruments and equipment is entirely responsible for the attractive prices at which Air-Way Radio parts and complete receiving sets are offered to the public. The Air-Way Green Seal Guarantee Tag attached to each Radio instrument is a symbol of quality that is known and preferred by experienced Radio buyers.

Air-Way Electric Appliance Corporation
TOLEDO, OHIO

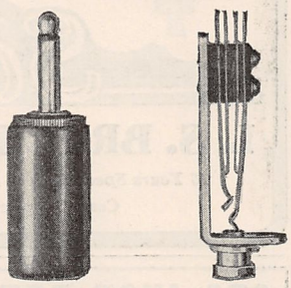
Air-Way instruments appeal most to those dealers who are wisely preparing to merit a successful and growing radio business by selling products of reputation and genuine quality at fair prices. Write for Air-Way Radio Bulletin.



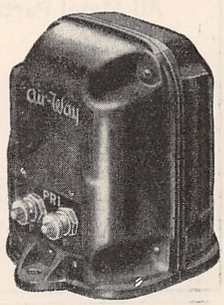
AIR-WAY new, light - weight, positive contact tube sockets save bulbs and maintain perfect connections. New design.



No professional operator would ask for a more precise and enduring instrument than the AIR-WAY Green Seal Variocoupler. It is built right and stays right.



AIR-WAY Jacks and Plugs are built especially for the finer radio apparatus to do away with the loose connections for which plugs and jacks are frequently responsible.



AIR-WAY Amplifying Transformers do more to eliminate the whines and shrieks than any other similar piece of radio equipment. They prove their own merit by comparison.

BRACH
Vacuum
LIGHTNING ARRESTER

Guards Your Radio Like a Sentinel, Day and Night

If you seek protection for your radio, if you wish freedom from interference by static, if you desire clear signals and beautiful voice and music receptivity, you should by all means install the Brach Vacuum Lightning Arrester, for many years recognized by skilled engineers of the great railroad and telegraph companies as the highest development in lightning protection.

The Brach Arrester is an unfailing sentinel—alert, awake ready for every attempted invasion—it works automatically like a valve on a steam system. It is made in two types—No. 200 for indoor use; No. 223 for outdoor service—both types "Built Up to a Standard—Not Down to a Price."

Listed by the Underwriters' Laboratories
SOLD BY LEADING DEALERS

safe-radio

L. S. BRACH MFG. CO., NEWARK, N. J.

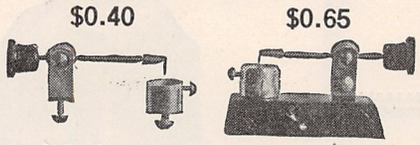
16 Years Specialists in Lightning Protective Apparatus. Also Makers of SOLDERALL

Coast Representatives: Pacific States Electric Co., San Francisco, Cal.

STA-JUST DETECTORS

Patented Ball Joint
All Metal Parts Nickel Plated

$0.40 $0.65



If Dealer cannot supply will send Parcel Post Prepaid upon receipt of Price

McCLOY ELECTRIC COMPANY
7131 KELLY STREET PITTSBURGH, PA.

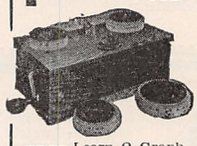
Wireless Operators Wanted

LEARN WIRELESS AT HOME IN SPARE TIME

The demand for experts exceeds supply. Pays big salaries, $125 to $250 a month to $10,000 a year. Our home course will make you an expert operator in shortest possible time. Instruction by radio experts. We give you Best Theory, Text-Books, and Two Instruments Free, the wonderful Omnigraph and

FREE VACUUM TUBE **Wireless Phone** AND CODE SET

Given Free with Professional Course.



Special Low Cost, Quick, Simple

AMATEUR WIRELESS COURSE

Qualifies For Amateur License

FREE Learn-O-Graph Code Sender given with Amateur Course.

Write for booklet "How to become a Wireless Operator."

NEW YORK WIRELESS INSTITUTE
154-V Nassau St. New York City

WANTED: Back numbers of Radio News, Sept., Oct., Nov. and Dec., 1921; Jan. and Feb., 1922.
EXPERIMENTER PUBLISHING CO., Inc., 53 Park Place, New York City

FIRST STEP, PANEL PREPARATION

(1) Lay out the panel as shown in Fig. 2. It is best to lay out this design on a piece of paper. The paper pattern may then be on the panel front and the various holes marked with a center-punch.

The layout given shows dimensions for the instruments used in the set built by the writer. If other makes are used, although the panel layout is practically the same, the various holes should be checked and placed in proper position.

Holes for the screws that are to attach the panel to the cabinet are not shown. In any case it is best to wait until mounting the panel before locating these.

(2) Drill the holes. Take care to see that you do not drill a small hole-mark for a ¼" shaft by mistake. The writer prefers to drill the *large* holes first, and before drilling each hole he checks and rechecks the same.

(3) Ream out the shaft holes slightly larger than the relative shafts. This allows for any slight irregularity in drilling holes for the attachment screws and keeps the shafts from binding.

(4) Countersink all holes for flathead attachment screws.

(5) Engrave the panel. If bakelite is used, it is best to have a professional engraver do the job. However, if hard rubber or black fibre is used the letters may be stamped in.

The panel shown in the photographs was a hard rubber panel. The letters were stamped in with a set of steel dies borrowed for the occasion. (Ordinary printers' type has also been used with fair success. Good, sharply cut block letters should be used, however, as such type is rather soft.)

(6) Give the back of the panel and also one side of a sheet of tinfoil a good coat of shellac and let dry. In shellacking the panel be sure to hold face up. This will prevent the shellac from running through the holes onto the face.

(7) When the above coats are dry, re-shellac the panel and tinfoil. Wait until the second coat has become gummy. Then stick the tinfoil on the back of the panel and let dry. (If desired, copper-sheet may be used in place of the tinfoil, but it is harder to work.)

(8) After giving the tinfoil shield a little time to set, take a sharp knife and cut away the shielding from about the shaft-holes, switchpoints, binding-posts, etc. However, the shield should not be removed from around the ground connection binding-post hole.

(9) When the tinfoil shielding has had time to set firmly in place, give it one or two coats of shellac and stick a sheet of brown wrapping paper over it. This protects the shielding and acts as an insulator to prevent accidental grounds. It should also be given an outside coat of shellac.

The panel should then be put away for at least 24 hours to dry.

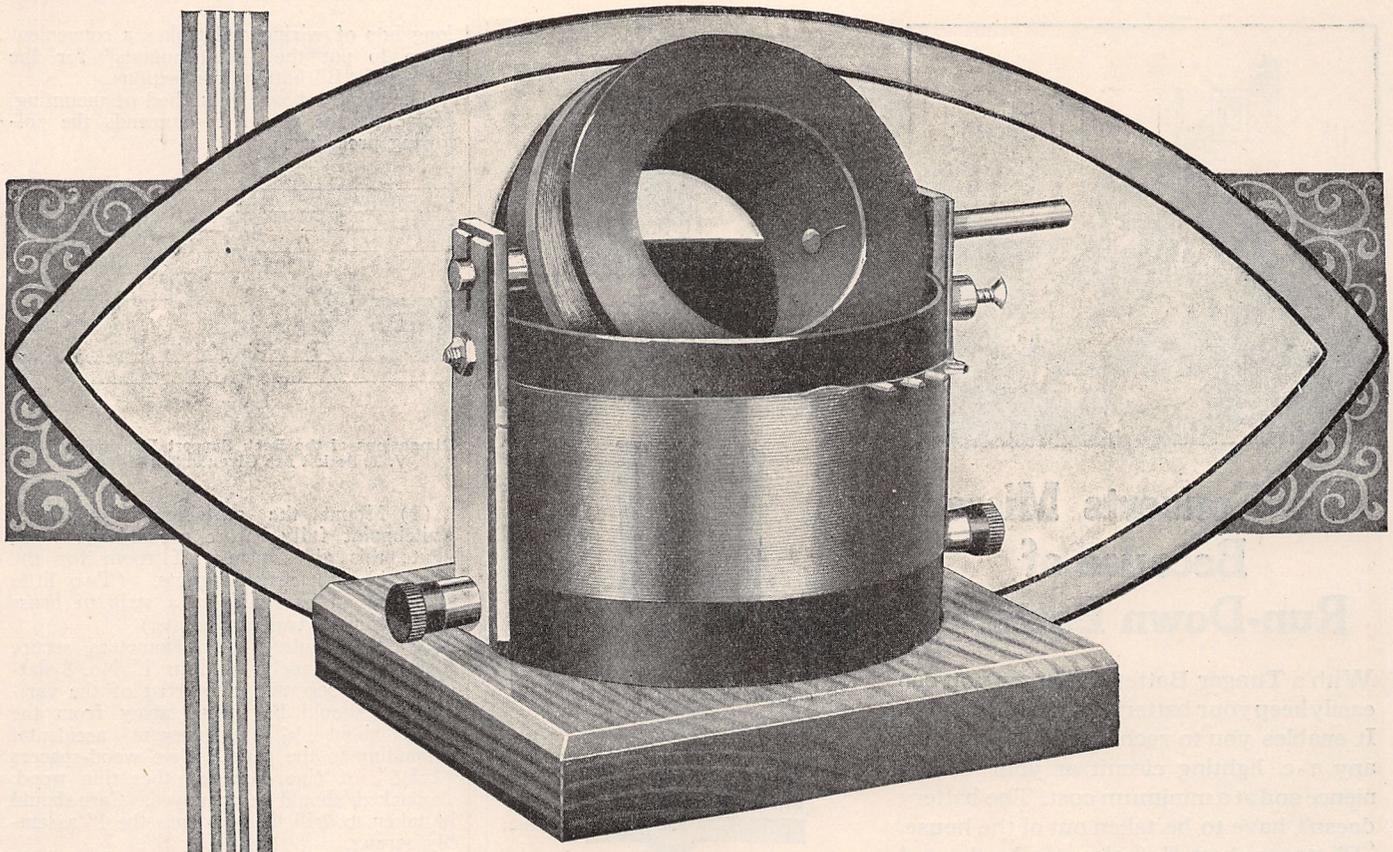
(10) Punch out the holes through the paper. This is done quickly and easily with a red-hot ice-pick.

The panel is now ready for the mounting of the instruments.

SECOND STEP, MOUNTING THE INSTRUMENTS

Fig. 4 shows the panel assembly; all the instruments are mounted either directly or indirectly to the panel. This makes the entire assembly a *unit* which may be removed at will from the cabinet and turned in any position for soldering or repairing.

The use of the brace across the back of the variometers is a novel wrinkle, which the writer believes to be the best mounting method for such an outfit ever tried. Besides providing a convenient mount for the tube-socket, it aids greatly in securing rigidity. It serves as a convenient support for



The Thoroughbred Vario-Coupler

An essential to every worth while radio set

IT IS an interesting thing to observe that A. Frederick Collins, inventor of the wireless telephone, in "The Radio Amateur's Handbook" (Thomas Y. Crowell Co., New York) places the vario-coupler first in the list of parts essential to a successful regenerative receiving set. This only serves to emphasize the importance of a proper vario-coupler as essential to every set.

The Thoroughbred Vario-Coupler because of its exclusive features is chosen by experienced amateurs to complete their sets. The Thoroughbred Vario-Coupler is of the all-moulded type which reduces losses and is not subject to dampness. The first seven taps on the primary are tapped one turn at a time and the last seven, a tap at each seven turns. The user is thus able to *tune in one turn at a time*—a feature not found on any other vario-coupler.

The amateur can use it with base on a table or he can mount it on a panel merely by removing this base.

The secondary of the Thoroughbred Vario-Coupler is wound with fine wire in order that it may be used for plate and tickler, thus doing away with the need for a variometer. On the average aerial it has a wave length of 200 to 700 meters. You can buy it at good radio and electrical stores for $5.00.

The Thoroughbred Vario-Coupler is but one of fifteen radio products manufactured by the Marshall-Gerken Company in their new and larger plant at Toledo, Ohio.

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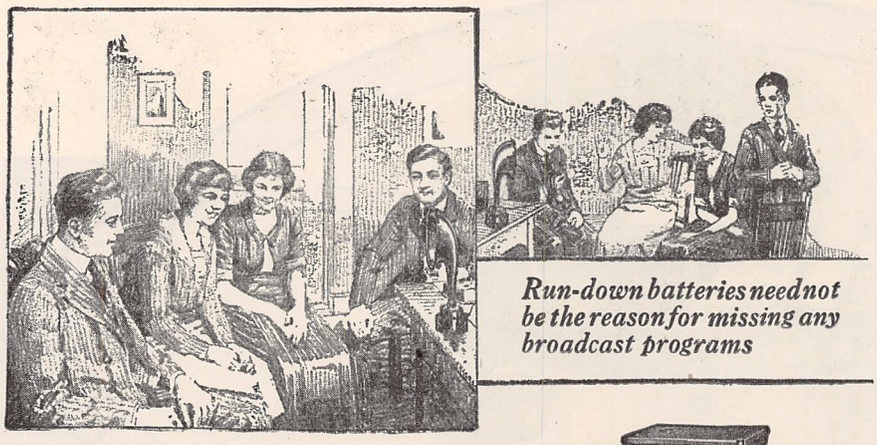
THE MARSHALL-GERKEN CO.

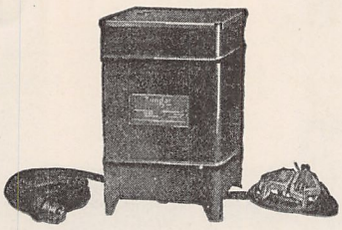
Jackson and N. 12th St. **Toledo, Ohio**

Thoroughbred Apparatus



Run-down batteries need not be the reason for missing any broadcast programs

No Concerts Missed Because of Run-Down Batteries



Tungar Battery Charger—saves disappointments and annoyance

With a Tungar Battery Charger you can easily keep your batteries up to full voltage. It enables you to recharge batteries from any a-c. lighting circuit at your convenience and at a minimum cost. The battery doesn't have to be taken out of the house. "B" storage batteries, also, can be charged by means of a simple, inexpensive attachment.

Tungar BATTERY CHARGER

The Tungar Battery Charger requires no attention while operating and is so designed that there isn't the slightest danger of injuring the battery. And its first cost is very low.

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long bits of wiring and makes a convenient place to put the "sub-terminals" for the "A" and "B" battery connections.

The photos show the method of mounting. However, the writer recommends the following procedure:

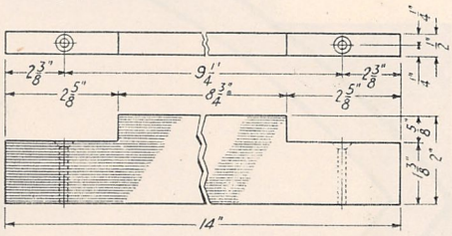

Fig. 3

Dimensions of the Back Support Which Holds the V. T. Socket Are Given in This Diagram.

(1) Mount the switchlever and each switchpoint fully before proceeding to the next; this gives plenty of room for the pliers in tightening the nuts. (Two little stops should be cut from a strip of brass or tin for the two end points.)

(2) In mounting the variometers, secure them to the panel with four 1" No. 8 flathead wood screws. The front of the variometers should be spaced away from the panel about 1/8" to prevent accidental grounding to the panel. Two wood-spacers 1"x3½", of cigar-box or other thin wood, shellacked, should be employed. Care should be taken to drill holes to pass the 1" assembly screws.

(3) Mount the variocoupler.

(4) Mount the filament rheostat. If Cutler-Hammer is used, it is best to mount with the terminals *down*.

(5) Mount jack.

(6) Mount binding-posts.

(7) Mount the wood-brace that serves also as a socket mount. The dimensions of this piece are shown in Fig. 3. This brace should be mounted ½" above the variometer base and care should be exercised to see that it is mounted *square*. Use 2" No. 6 flathead woodscrews and take care they do not penetrate the stator windings.

Now test for accidental *panel grounds*. If none are discovered, the unit is mounted and all is ready for the wiring.

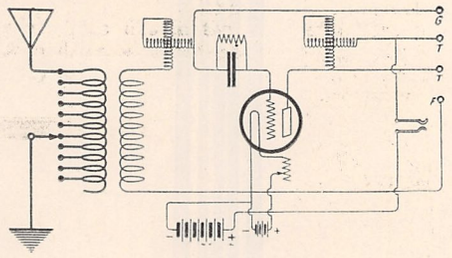

Fig. 4.
Wiring Diagram of This Short-Wave Receiver. The Same Tuner Can Be Used With Another Detector.

THIRD STEP, WIRING

The hook-up used in this set is shown in Fig. 4.

Figs. 5 and 6 show photographic views of the wiring. The circuit is the good old standard two-variometer circuit. The diagram of connections shows the proper order in which to make the connections if convenience in soldering is desired. The "inside" and "close-to-the-panel" connections are made first. The arrowheads show the beginning and end of each wire. Using the pictured views in Figs. 5 and 6 and taking a little care in making right-angle bends and using straight wire will produce a remarkably neat and workmanship looking outfit.

Connections (2), (17) and (18) should be made of flexible lamp cord. Connections (3) should be made of No. 20 bare or D.C.C. All other connections should be made

This is station K.S.&S.Co.

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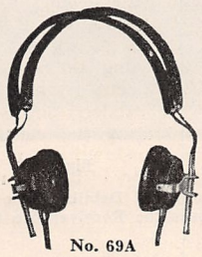
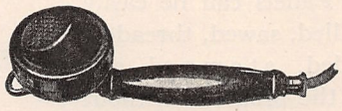
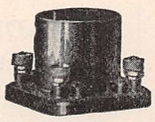


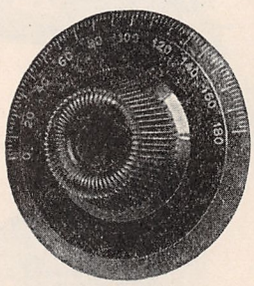
No. 69A
Head Set



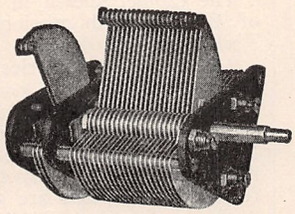
No. 21 Microphone



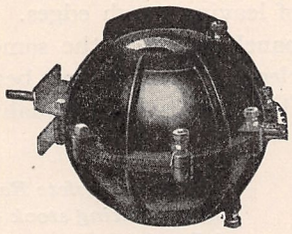
No. 2
Tube Socket



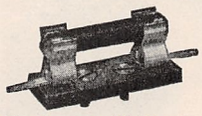
No. 501 Dial



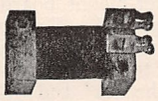
No. 505 Variable Condenser



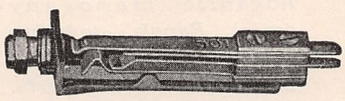
No. 501 Variometer



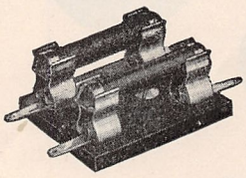
Grid Condenser with No. 502 Mtg.



Air Choke Coil

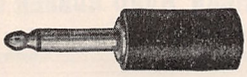


No. 501 Four Conductor Jack

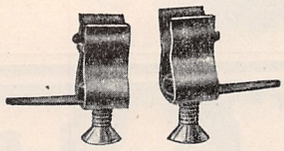


Grid Leak and Condenser
with No. 503 Mtg.

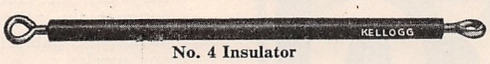
Iron Core Choke Coil



No. 501 Plug



Set of 501 Condenser Mtg. Clips



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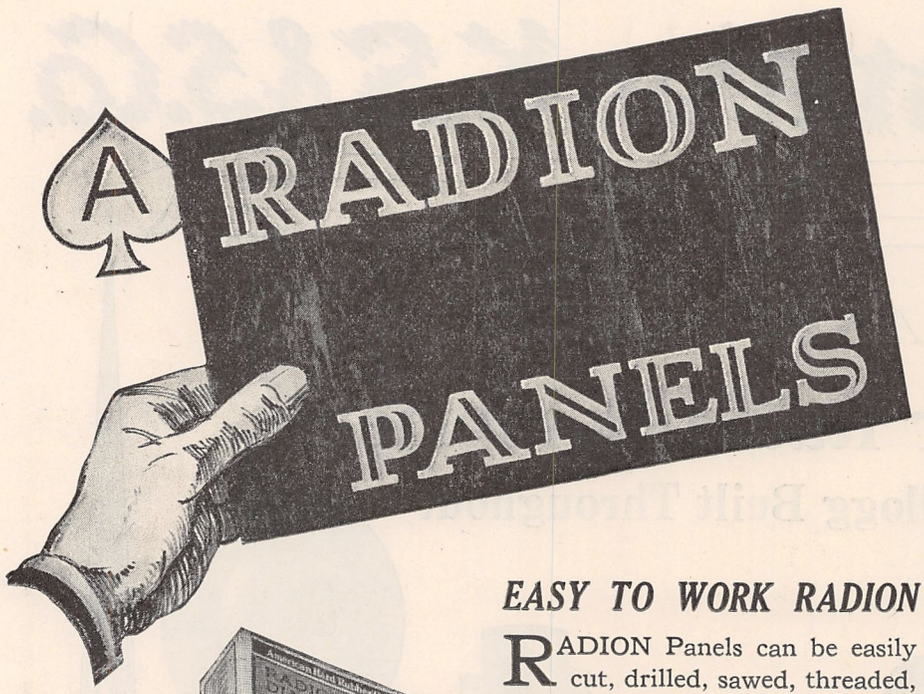

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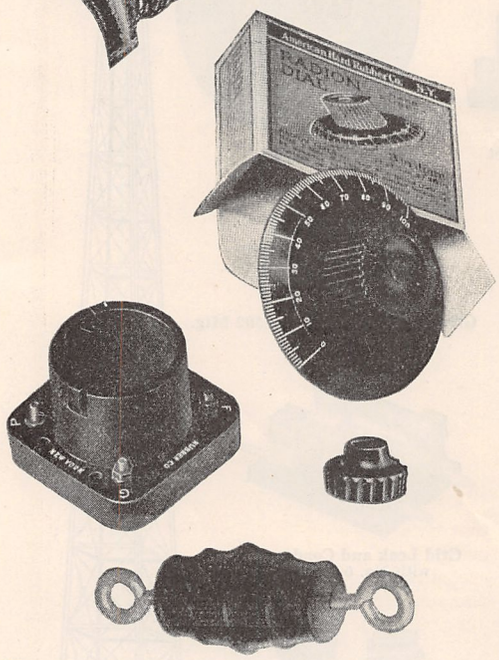

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of No. 14 bare copper or larger. Connections (3) should be covered with spaghetti, which should also be used to cover any wires which are in danger of touching others.

When the connections shown in Fig. 4 are completed, they should be tested for misconnections. If none are found, the unit is ready to be placed in its cabinet.

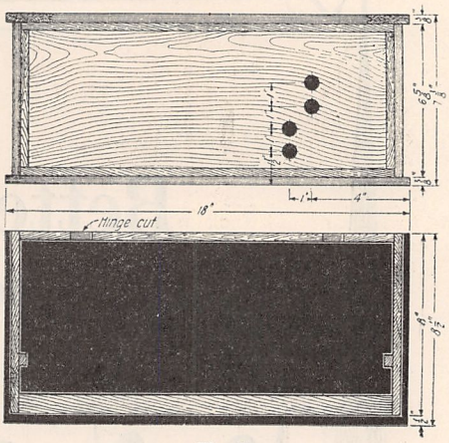

Fig. 7

Dimensions and Details of the Cabinet Which Encloses the Receiver Are Given Here.

FOURTH STEP, PLACING IN CABINET

The cabinet shown in Fig. 7 was made of 3/8" oak, with mission finish, measuring 7"x18" by 8½" deep.

"A" and "B" batteries are connected to binding posts at the *rear* of the cabinet. Their location is shown in Fig. 7.

Fig. 7 gives the dimensions and layout. You will notice that the cabinet is of the flush panel type. Only the over-all and a few odd dimensions are given.

The binding posts for "A" and "B" should be connected to the sub-terminals on the socket-mount board by one-foot lengths of lamp cord. This makes it easy to remove the wired tuner-detector unit from the cabinet, to get at any part of the set. As soon as the "A" and "B" connections mentioned are made, the unit should be placed in the cabinet and the screws that hold it in place put in. The letters should then be whitened. The writer used white shoe-polish and a steel pen. This fills in the indented letters and soon dries.

The dials should be put on last, and when they are in place it is only necessary to connect the antenna and ground wires and attach the batteries, when the outfit is ready for work.

The four binding-posts *G, T, T, F* enable an external detector to be connected. The next article will describe a detector and two-step audio frequency amplifier unit that matches up with this one.

The writer will be glad to answer any questions regarding this set if a self-addressed and stamped envelope is sent him.

Construction of a High-Voltage Storage Battery

(*Continued from page* 656)

top at the other end. After the paraffin hardened and the tilting blocks were removed a sloping surface resulted which is convenient for washing out any acid or dirt. A flared g ass tube was put through the bottom of the tray at the lower end to drain off any water or acid.

The plates for the battery come in pairs consisting of one positive and one negative plate joined by a lead link, the plates going in adjacent cells and being supported by the lead link. The battery was made up in such a

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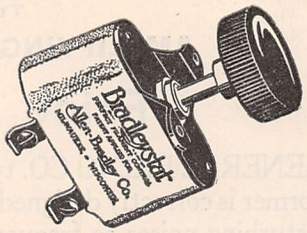

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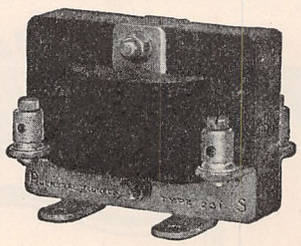

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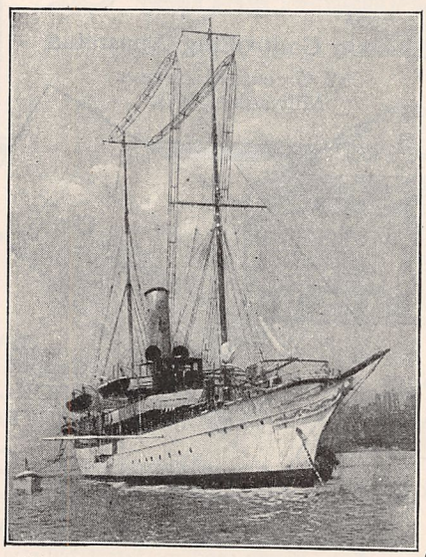

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THE world was set agape not long ago by a report that mysterious radio signals had been received from the planet Mars by Signor Marconi. The delicate sensibilities of the Copper wires with which the *Elettra* is equipped apparently had detected and defined sound waves that had received their initial impulse millions of miles away.

Whether or not in this instance Mars was no further than Schenectady, the fact remains that Copper does its job so well that those who want the best radio results are taking no chances with substitutes.

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way that its terminals were at the opposite end from which the tray is drained.

Chemically pure sulphuric acid is diluted to bring the specific gravity to 1.210. Directions for mixing the electrolyte may be found in any handbook on storage batteries. The electrolyte in the jars should come about one-fourth inch above the top of the plates.

Paraffin covers were made for the cells. The majority of covers in use consist of one long cover for each row of cells. The paraffin was poured into a wooden mold or trough about 1½x18¼ inches forming a piece about ¼ inch thick. While the cover was still warm, it was removed from the mold and placed on top of the row of cells where it was pressed down and conformed to the tops of the jars and lead links. In the center above each jar a considerable depression was made and a small hole made for gases to escape. This method gives a convex surface to the under side of the cover so that the spray forming when the cell is charging collects on the cover and forms droplets which are returned to the electrolyte. As would be expected the covers have reduced the evaporation greatly in addition to keeping dust out of the cells. When the batteries are on charge no spray or fumes are noticeable in the room.

Each terminal of each battery comes out to the blade of a single-pole double-throw switch mounted on the vertical supports of the tray. The lower terminals of all positive terminal switches are connected together, the same being true of the negative terminal switches. By throwing all of the switches downward, the batteries are placed in parallel either for obtaining 100 volts or for charging from the 110-volt direct current mains. The batteries are connected directly to the 110-volt mains through small fuses when charging. The upper terminals of the switches are connected in series, positive to negative, and have suitable binding posts attached to each pair of switch terminals for the wires from the radio-frequency generator. By a suitable throwing of switches any voltage from 100 to 600 may be obtained with these batteries. The voltage obtained of course depends on the number of trays. When operating the larger electron tube, three of the batteries may be in use while the other three are being charged.

Quite a number of these batteries have been used by the Radio Laboratory of the Bureau of Standards and they have been entirely satisfactory for supplying a small constant current such as is necessary for electron tube generators. To obtain best results the batteries must be given some attention to see that the jars are kept filled with distilled water to a height somewhat above the top of the plates and are charged from time to time. How often the batteries are charged depends on how much they are used. It is preferable to charge them oftener and keep them well charged than to use them to the limit, charging them only at wide intervals or when nearly run down. The trays should be washed out once in two or three weeks with clean water to remove any collected acid or dirt.

As has been previously stated, storage batteries of this general type (using same type of element) have been in use in the Radio Laboratory for over four years. While no definite data have been collected to show the useful life of such high-voltage batteries some very conservative estimates may be given. The life of such batteries is greatly influenced by the care afforded them. Good care includes keeping the jars and wax free of acid spray and dust; keep jars properly filled; keep within the proper ampere-hour charge and discharge rate; and if batteries are not normally used at the specified discharge rate, they should be exercised about every two weeks by discharging, through a resistance, at the proper discharge rate and then recharged. Batteries of this type which have been given proper attention have been in use for over four years and are yet quite serviceable. Others have gone to ruin in six months for want of care.

A Word About Price!

Something that everyone interested in Radio should know

THE Automatic Electric Head Set has been developed and completed to give a maximum loudness and clearness under all conditions.

Some of the outstanding features have been discussed in these pages. Price has been quoted at $10.00, with plug attached $11.50. This is a *fair* price. It covers development and manufacturing costs plus a reasonable profit.

On account of the widespread demand for Radio equipment, it is difficult to judge real values by the various prices you see quoted. High price may not necessarily mean commensurate quality. That is why it is safer to buy a product whose origin you *know*.

Automatic Electric Company has been making high class telephone apparatus for over thirty years. This perfected Radio Head Set is the result of years of experience and technical knowledge, backed by the reputation of this house. And it is our aim to give you the best Head Set ever produced, to fit all requirements.

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ENGINEERS, DESIGNERS & MANUFACTURERS OF THE AUTOMATIC TELEPHONE IN USE THE WORLD OVER

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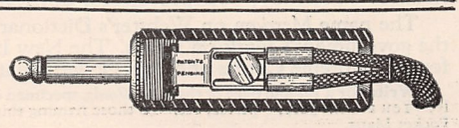
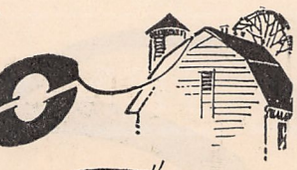
This is the high grade plug that comes attached, when desired, to *Automatic Electric Head Sets*. It will take care of any kind of cord terminals, will fit any kind of jack and will accommodate two head sets. With this plug attached to our head set you can be sure the head set is properly "poled."



Radio



The Greatest Radio Offer of the Year—Absolutely Complete, $49.50

This special receiving outfit will give as good results as any outfit of this improved type on the market. It is absolutely complete, there is nothing extra to buy. We include everything—you simply put up the aerial, connect the instruments, which is easy to do, and in less than half an hour you can be receiving signals, radio music, lectures, stock reports, market reports, or any other radio program sent out.

In making tests with this set in Chicago we regularly heard Detroit, Pittsburgh and other stations were often tuned in. Of course, atmospheric conditions affect the range of this or any other receiving set made.

Highest Development in Radio Receiving

This outfit will equal in results any outfit of this type regardless of price. It is especially made for us and has behind it the fifty year old guarantee of Montgomery Ward & Co.: "Satisfaction guaranteed or your money back." You take no risk whatever in ordering this set.

Long Distance Vacuum Tube Receiving Set

The complete outfit includes our special Combined Tuner and Detector; Special 2000 ohm Double Head Set; Radio Storage Battery; one Detector Tube, one "B" Battery; and complete antenna and connecting equipment including 150 feet bare copper wire and 25 feet insulated wire, porcelain tube; double throw switch; 2 antenna insulators; lightning protector; ground clamp, 2 screw eyes and 25 feet of wire for instrument connections.

Order this set at our risk. It will be packed carefully and shipped immediately from our nearest house. Shipping weight 40 pounds.

563Z599—Complete Outfit..... **$49.50**

Order this outfit today and start at once enjoying in your home the most marvelous invention of the age.

Price of receiving Set without batteries, head piece, switch and aerial, shipping weight 8 pounds: **563Z598**—$27.50.

Send money order or check to the one of our five houses that is nearest to you.

MONTGOMERY WARD & CO., Dept. 2-R
Chicago Kansas City Saint Paul Fort Worth Portland, Ore.

RADIO CATALOG
FREE

This FREE catalog tells you the kind of Wireless Equipment to own, so that you receive in your own home all the latest news, music, Church services, lectures—everything that is broadcasted. Everyhome should haveawireless telephone outfit. We now offer complete outfits from $12.95 up. Everyone interested in radio should see our low prices on parts and accessories. Write for this book. Learn about the miracle invention of the age. Easy to install, simple to operate.

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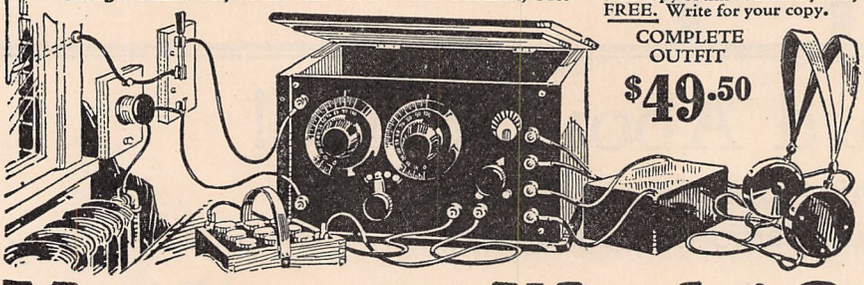


COMPLETE OUTFIT
$49.50

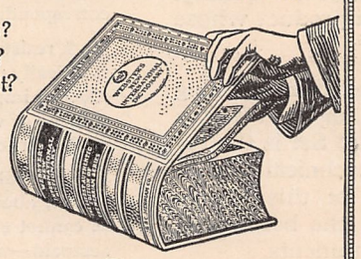
Montgomery Ward & Co.

The Oldest Mail Order House is Today the Most Progressive

Service

"I had six honest, serving men;
(They taught me all I knew);
Their names are WHAT and WHY and WHEN,
and HOW and WHERE and WHO." (KIPLING)

WHAT was the Declaration of London? WHAT are consols?
WHY does the date for Easter vary from year to year?
WHEN and by whom was the great pyramid of Cheops built?
HOW can you distinguish a malarial mosquito?
WHERE is Canberra? Zeebrugge? Delhi?
WHO was Mother Bunch? Millboy of the Slashes?
Are these "six men" serving you too? Give them an opportunity by placing



WEBSTER'S NEW INTERNATIONAL DICTIONARY

in your home, office, school, club, shop, library. This "Supreme Authority" in all knowledge offers *service*, immediate, constant, lasting, trustworthy. Answers all kinds of questions. A century of developing, enlarging, and perfecting under exacting care and highest scholarship insures accuracy, completeness, compactness, authority.

The name *Merriam* on Webster's Dictionaries has a like significance to that of the government's mark on a coin. The NEW INTERNATIONAL is the final authority for the Supreme Courts and the Government Printing Office at Washington.

Write for a sample page of the *New Words*, specimen of Regular and India Papers, also booklet "You are the Jury," prices, etc. To those naming this magazine we will send *free* a set of Pocket Maps.

G. & C. MERRIAM COMPANY, Springfield, Massachusetts, U. S. A.
Established 1831

Name..... Address..... R. N.

RECOMMENDED CHANGES IN CONSTRUCTION

The wooden tray should be provided with a lining of sheet lead of 1–16 inch or less in thickness. This could be made up and dropped into the wooden box, all seams being sweated together. The inside of the lead box should be painted with insulating varnish. The lead box will protect the wood from the action of the acid, which seems to creep through the paraffin to some extent. If the lead box is used in the construction of the trays, precautions should be taken to prevent current leakage down the side of one cell, across the lead sheet and up the side of another cell. Careful painting of the inside of the lead box with asphaltum varnish and the precautions mentioned in the following paragraph should eliminate any such trouble.

In the present battery the individual jars in a row are set without any space between them. In very warm weather this is apt to cause the row to buckle as has been noticed. The worst feature of this construction, however, is the creeping of acid and moisture down between the glass jars. When the paraffin is first poured in, it is difficult to get it in between the jars thoroughly. This may permit acid and water, when the trays are washed out, to collect between the jars and work their way between the first and second layers of paraffin and out to the wood box. Some leakage of current also may take place. Hence the following method of construction is suggested. In setting up the battery allow a separation of $\frac{3}{8}$ inch between the jars in each row with the present spacing of one inch between rows. This will allow the paraffin to flow readily in between and around all jars. While the paraffin is still in the liquid state if it is splashed up around each jar a tight seal should be produced.

Individual covers for each cell could easily be made of paraffin which would cover the cells more tightly than the covers used at present, and still further reduce the evaporation and probable current leakage from cell to cell. An advantage of having one cover for each row of cells is that each row may be readily inspected as to the condition of the individual cells in the minimum of time. A possible disadvantage is the current leakage from cell to cell along the cover but this condition if present does not seem to seriously affect the performance of the battery.

The illustration shows the general features of construction.

DIMENSIONS OF TRAY

Approximate Voltage	Rows	Cells per Row	Distance between rows	Distance between cells	Tray inside Dimensions	Remarks
100	4	12	1	0	11¼x19	Present tray
100	4	12	1	⅜	11¼x24¼	Suggested size rather unwieldy
50	3	8	1	⅜	8½x16¾	Suggested size too low voltage.
100	5	10	1	⅜	13¼x20½	Suggested size

(Abstract from Journal of Optical Society of America)

The Universal Receiver

(Continued from page 663)

aluminum or copper sheeting is used but it is more difficult to attach and tinfoil is just as efficient. Get a heavy grade, smooth it out as flat as possible and cut it one-half inch smaller, all around, than the main panel. The sub panel does not need shielding. Shellac will be fine for holding the tinfoil, if, after coating the rear of the panel with it, it is allowed to become tacky before placing the foil. Press the foil on heavily so that there will be no air bubbles to blister.

(Continued on page 713)

KNOW WHO IS SENDING

Get twice the pleasure and usefulness out of your receiving set. Look up the name and location of any ship or land station whose messages you pick up—learn the name and address of that amateur whose sending set you just heard.

Now Ready! 4th Edition of the CONSOLIDATED RADIO CALL BOOK

In a new large size—280 pages—88 more valuable pages than the 3rd Edition and featuring

7 Two-Color Radio Maps

Five of them are Continental Maps showing all stations throughout the world handling commercial traffic, with their calls; one showing the amateur radio districts of the United States and the principal radiophone broadcasting stations with their calls; and a map of the United States Weather Forecast Zones. Seven wonderful, two-color radio maps with a wealth of information that will give you a great deal of pleasure and knowledge.

Every Amateur Call in the U. S. and Canada Is Listed!

All Amateur Radio Calls of the United States and Canada; Every Vessel, Coast Station, and Radio-Compass Station in the World; Radiophone Broadcasting Stations of the United States; Every High-Power Station in the World; Special Land Stations of the United States; Time Signals, Hydrographic and Weather Reports of the United States and Principal Foreign Countries; International Abbreviations; Assignment of International Calls; Press Schedules; Radiogram Rates; Cable Rates; International Morse Code and Continental Signals; and Complete General Information covering Distress Calls, International Safety Signal, Use of 800-Meter Wave Length, Amendments and Changes in Various Governmental Regulations, How to Determine Charges on Radiograms, Free Medical Advice by Radio to Vessels, and much other useful information.

$1.50 Prepaid

Some of the Valuable Information Contained in This New Book:

And every vessel and land station in the world is represented and listed alphabetically, according both as to name of vessel or land station, and to call letters.

The Consolidated Radio Call Book is the only book in print officially listing all the Radio calls as issued by the Bureau of Commerce. And the New Radiophone Broadcast Section is particularly complete and gives all available information concerning calls, wave lengths, PROGRAMS, etc.

The third edition of 10,000 copies was exhausted in two weeks. The fourth edition is selling just as quickly. Don't wait until it is all gone. Order at once, either direct from us or from your favorite dealer.

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Great 38-page Supplement FREE to all who have the 4th Edition Call Book

As a special service to the readers of the Fourth Edition of the Radio Call Book, we have printed, at great expense, a 38-page supplement containing the latest amateur radio calls of both the United States and Canada, and other calls issued very recently. It is absolutely free to all those who write for it, provided you have bought a copy of the fourth edition of the Consolidated Radio Call Book. This wonderful supplement brings the call book up to the very last moment and on account of the many changes that have taken place and which are fully covered by this supplement, every radio amateur or professional is urged to send for his free copy of this supplement today.

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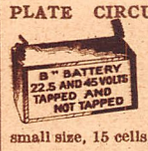
BUILD YOUR SET WITH BARAWIK STANDARD

PLATE CIRCUIT "B" BATTERIES



You can make real savings on these batteries. Don't pay more. We guarantee them to equal any on the market regardless of price. Absolutely uniform. Extra long life.

J180 Signal Corps type, small size, 15 cells, 22½ volts. Each.....95c

J182 Large Navy size, 6½x4x3, 15 cells, 22½ volts. Each.....$1.75

J184 Variable Large Navy size, 5 taps, giving range from 16½ to 22½ volts in 1½ volt steps. Each.....$1.80

J186 Double Navy size 6½x4x6, 30 cells, 45 volts. Suitable for amplifier circuits and power tube use. Two or more of these units in series may be used in C. W. and radiophone circuits. Each.....$3.40

J188 Combination Tapped 45 volts, 30 cell, 6½x4x6 battery. Tapped to give 45, 22½, 21, 19½, 18, and 16½ volts. Handles both detector and amplifier tubes. Each.....$3.55

4½ VOLT "C" BATTERY UNIT

For use in grid circuit. Also can be used to make up "B" batteries.

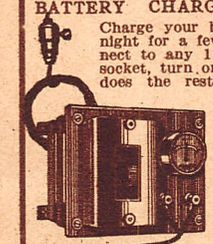
J189 Each.....39c

WILLARD "B" STORAGE BATTERY

Better results. No battery noises. Cheaper in the long run. Easily recharged by our Battery Charging Rectifier. Leak proof glass jars. Will last for years.

J205 Price.....$9.00

BATTERY CHARGING RECTIFIER



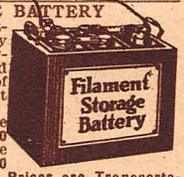
Charge your battery at home over night for a few cents. Simply connect to any 110 volt 60 cycle light socket, turn on current and rectifier does the rest automatically. Will work for years without attention. Simple connections. Gives a tapering charge which batteries should have. You can make it pay a profit charging your friends' auto batteries. Long connecting cords with pair of battery clips.

Prices are Transportation Paid

J201 For 6 volt battery.....$13.95

J203 For 12 volt battery.....13.95

STORAGE BATTERY



A very high grade battery made especially for radio service. Guaranteed. Properly cared for will give years of service for filament lighting.

J194 6 volt, 40 ampere size. Each.....$10.00

J196 6 volt, 80 ampere size. Each.....$12.50

Prices are Transportation Paid

BATTERY CLIPS

J198 Two for.....28c

Clip onto storage battery terminals. Lead coated. Make positive non-corrosive contact at all times.

WIRE CONNECTING CLIPS

J199 Per dozen.....30c

Small connecting clips for fastening leads onto binding posts, etc. Handy and useful. Every experimenter should have at least a dozen.

PORCELAIN BASE SWITCHES

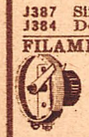
Fine white porcelain bases. Copper contacts and blades. Can be used as antenna switches.

J385 Single Pole Single Throw. Each.....20c

J387 Single Pole Double Throw. Each..32c

J384 Double Pole Double Throw. Each.50c

FILAMENT CONTROL RHEOSTATS



Crosley—Wound on vulcanized fiber. Adjustable to any panel. Complete with knob.

J130 Each.....54c

Best grade. High heat resisting base. Diam. 2⅛ in. cap. 1½ amp. Resist, 6 ohms. 1¼ in. Knob with pointer.

J132 Each.....70c

POTENTIOMETER

Same style as above rheostat. Gives fine "B" battery adjustment. Resistance 100 ohms.

J133 Each.....$1.18

VERNIER RHEOSTAT

Gives exceedingly fine control of a battery current. A necessity for best receiving results.

J135 Each.....$1.19

QUICK ACTING VERNIER RHEOSTAT

Gives very fine control of current and can be switched on or off instantly at any desired point.

J124 Each.....$1.27

Porcelain Base Rheostat for table mounting. Resist, 10 ohms.

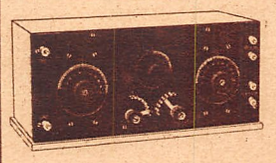
J136 Each.....78c

WE PAY TRANSPORTATION CHARGES EAST OF THE ROCKIES

THE PRICES QUOTED DELIVER THE GOODS TO YOUR DOOR
FAST SERVICE—TRY US AND BE CONVINCED

THIS GUARANTEE PROTECTS YOU—Examine the goods we ship you. They must suit you in every respect. If you are not satisfied with your purchase return the goods at once and we will refund the price you paid.

SPECIAL OFFER ON TWO HIGH GRADE RECEIVING INSTRUMENTS



Regenerative Tuner and Detector—Two Step Amplifier

J220 The two for.....$67.50

This is a combination unequalled for clear long distance radiophone receiving. With a good aerial the range is only limited by the power of the transmitting set. Send for complete descriptive circular.

REGENERATIVE TUNER

J224—Price $37.50

This is a standard make Armstrong licensed set. Range from 180 to 600 meters. Will tune sharply and bring in signals strong even under difficult conditions. Fine Mahogany finished large size cabinet. Satin finished Formica Panel. Two high grade variometers, with variocoupler for closest tuning. Engraved dials, knobs, switches, binding posts for all necessary connections, etc. A high grade outfit worth much more than we ask.

DETECTOR-TWO-STEP AMPLIFIER

J222—Price $35.00

A very sensitive high grade instrument. Signals that cannot be heard with detector alone, will be brought in strong. Has one detector and two amplifying circuits. Standard tube sockets, grid condenser in detector circuit two amplifying transformers, 3 jacks and a plug. Satin finished Formica Panel. Fine Mahogany finish large size cabinet. Hinged top. Interior easily accessible. Binding posts for all necessary connections.

VACUUM TUBES

Standard Brands—Cunningham Radiotron. Every one guaranteed new and perfect. We will ship brand in stock unless you specify otherwise.

J105 Detector. Each.....$5.00

J110 Amplifier. Each.....6.50

J115 5 Watt Transmitter....8.00

MYERS TUBES

These tubes have many desirable characteristics that have made them great favorites. No critical adjustments. Low battery consumption. Clear signals. Great sensitiveness on long distance reception. Small size. Rigid construction. No tube noises due to mechanical vibration. Perfect oscillator. Excellent as audio or radio frequency amplifier. Especially satisfactory on Armstrong super regenerative circuits. Can be used in Myers receptacle or in any standard socket with adapter listed.

J111 RAC-3 Audion. Each.....$3.50

J113 High-Mu Audion. Has 5 times amplification of ordinary tubes. Oscillates anywhere from 2 to 300 volts on plate. Each.....$5.00

J116 Receptacle for above. Each.....$1.00

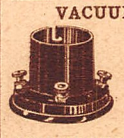
J117 Adapter to adapt Myers tubes for use in any standard socket. Each.....$1.05

MYERS CHOKE COIL

For Audio Frequency Amplification. Designed to work with Myers tubes. Brings in loudest possible signals. Flexible over a broad band of wave lengths. Free from amplifier noise. Free from distortion. Mounts in Myers special receptacle.

J119 Each.....$3.50

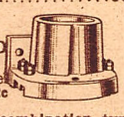
VACUUM TUBE SOCKETS



Our Special Socket. A wonderful value. Moulded entirely of bakelite. Four binding post connections. Right angled contact springs.

J140 Each.....39c

PORCELAIN BASE AND TUBE



J144 Crosley for either panel or table mounting.....42c

High Grade combination type for panel or table mounting. Metal tube. High insulation base.

J146 Each.....69c

Paragon combination type for panel or table mounting. One of the best designed and best made sockets on the market. Metal tube bakelite base.

J148 Each.....$1.10

TWO AND THREE GANG SOCKETS

These sockets make it easy to build detector and amplifier units and make a neat, compact, workman-like job. Perfectly made of high grade materials. Metal tubes mounted on fiber base. Quickly mounted on panel or base.

J147 Two gang socket.....$1.20

J149 Three gang socket.....$1.65

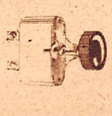
FIXED CONDENSERS

Moulded cases, nickeled binding posts.

J802 .005 Mfd. Each..49c

J804 .01 Mfd. Each..59c

CARBON PRESSURE DISC VERNIER RHEOSTAT



Current regulation is obtained by changing of pressure on carbon discs. This permits of infinitely fine variation of current. Very durable. Resistance 15 ohms. Capacity 2½ amperes.

J131 Each.....$1.48

VARIABLE GRID LEAK

Pencil mark type. Resistance may be varied exactly as needed.

J160 Each.....24c

GRID CONDENSER

J162 Mounting holes spaced to fit lugs of above leak. Cap. .00025 MF.....19c

J163 Same as 162 but higher grade. Enclosed in metal case.....39c

PHONE AND GRID CONDENSERS

A compact, inexpensive style of condenser that is very satisfactory and durable. Conducting sheets and dielectric are wound on fiber strip with eyelets for mounting and connections.

Price, each.....12c

J170 Phone Condenser .001 Mfd.

J172 Phone Bridging Condenser .0005 Mfd.

J174 Grid Condenser .00025 Mfd.

J176 Grid Condenser .00025 with pencil mark leak. Each.....24c

TUBULAR GRID LEAKS AND CONDENSERS—MOUNTED STYLE

Very convenient. Permits quick change of leaks or condensers of varying capacities.

Grid Leaks. Price, Each.....67c

Resistance		Resistance	
J850	.5 Meg.	J855	2. Meg.
J851	1. Meg.	J857	3. Meg.
J853	1.5 Meg.	J859	5. Meg.

Grid and Plate Condensers. Price, each...55c

J830 .000025 Mfd. Correct for Myers Tubes.

J832 .0001 Mfd. For special circuits.

J834 .00025 Mfd. For U. V. 201 and Cun. 301.

J836 .0005 Mfd. For U. V. 200 and Cun. 300.

Mountings. Bakelite base. Spring clip contact.

J840 Single mounting. Each.....38c

J842 Double mounting. Each.....57c

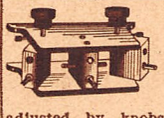
J844 Triple mounting. Each.....76c

INDUCTANCE "HONEY COMB" COILS

Carefully made—fine looking coils. Highest efficiency. Low distributed capacity effect, low resistance—high self inductance. Very firm enamel impregnation. Range given is in meters when varied with .001 variable condenser. Mounted coils have standard plug mountings.

Turns	Range	Price Art. No.	Not Mntd.	Art. No.	Price Mntd.
25	120- 250	J301	$0.39	J320	$0.97
35	175- 450	J302	.42	J322	1.00
50	240- 720	J303	.49	J323	1.07
75	390- 910	J304	.54	J324	1.12
100	500- 1450	J305	.58	J325	1.16
150	600- 2000	J306	.63	J326	1.21
200	900- 2500	J307	.72	J327	1.30
250	1200- 3500	J308	.78	J328	1.36
300	1500- 4500	J309	.82	J329	1.40
400	2000- 5000	J310	.97	J330	1.55
500	2800- 6100	J311	1.12	J331	1.70
600	4000-10000	J312	1.27	J332	1.85
750	5000-12000	J313	1.43	J333	2.00
1000	7900-15000	J314	1.70	J334	2.38
1250	9750-19500	J315	1.92	J335	2.60
1500	14500-26500	J316	2.18	J336	2.76

COIL MOUNTINGS



J340 Three coil mounting.....$3.95

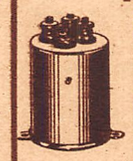
High grade fine looking mountings. Polished black composition. Center receptacle stationary, two outer ones adjusted by knobs. Takes any standard mounted coil.

COIL PLUGS

Made of moulded bakelite. Fits any standard plug. Mounts any standard honeycomb coil.

J344 Each.....50c

RADIO FREQUENCY AMPLIFYING TRANSFORMER



J995 Each.....$4.50

This transformer will get the long distance stations loud and clear. Permits of easy sharp tuning. Helps cut out static and interference. Makes your set sensitive enough to use a loop aerial. Enclosed in metal case affording perfect shielding. Suitable for panel or base mounting. Because of its special design can be mounted in any V. T. socket. Works with any make of tube. Wave ranges 150 to 550 meters. Wiring diagrams included.

OUR SPECIAL AUDIO FREQUENCY AMPLIFYING TRANSFORMERS

We believe these transformers to be the best on the market. We offer them with two winding ratios—the 10 to 1 for Radiotrons and Cunninghams—the 3 to 1 for A. P. Moorehead. These two types of tubes have entirely different characteristics and therefore require transformers of different winding ratios. As high as three stages can be used without howling due to proper impedence ratio, minimum distributed capacity, low core losses and proper insulation. Mounted style has bakelite panel with binding post connections. Unmounted has core and coils assembled with two holes in core for fastening to apparatus.

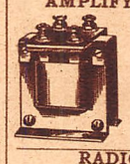
J234 10 to 1 Mounted. Each.....$3.95

J235 10 to 1 Unmounted. Each.....3.20

J236 3 to 1 Mounted. Each.....3.90

J237 3 to 1 Unmounted. Each.....3.10

THORDARSON AUDIO FREQUENCY AMPLIFYING TRANSFORMER



An especially high grade transformer with correct characteristics for Cunningham, Radiotron or A. P. Tubes. Wonderful results without distortion on one, two or three steps. Low distributed capacity. Fully mounted bakelite panel.

J232 Each.....$4.00

RADIO CORPORATION TRANSFORMERS

Audio Frequency Amplifying Transformer. Especially designed for Radiotron tubes. 9 to 1 winding ratio.

J712 Each.....$7.00

RADIO FREQUENCY AMPLIFYING TRANSFORMER

Range 200 to 5000 meters. For long distance reception.

J714 Each.....$6.50

OUR COMPETITOR AUDIO FREQUENCY AMPLIFYING TRANSFORMERS

While these are very low priced transformers, nevertheless they will give excellent results. They are carefully designed and carefully made. Quantity production and small profits make the low price possible. They will equal in results many transformers selling at much higher prices.

J238 Unmounted, with wire leads.....$2.00

J239 Mounted, with binding post connections.....$2.75

BARAWIK SPECIAL PANEL MOUNTING VARIABLE CONDENSERS

J812—43 plate .001 Mfd. $2.95

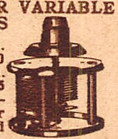
J813—21 plate .0005 Mfd. 2.55

J814—11 plate .00025 Mfd. 2.15

J815—3 plate Vernier.....1.48

These are especially high grade condensers and we guarantee them to be mechanically and electrically perfect. Fine polished end plates of high dielectric and great mechanical strength. Sturdy aluminum alloy plates perfectly spaced to insure smooth, even reliable capacity. Our low prices save you money. These condensers are of the very best make and are not to be compared with many inferior cheap condensers offered. We guarantee them to please you or your money back.

COMBINATION VERNIER VARIABLE CONDENSERS



J824—23 plate .0005 Mfd. Price.....$4.30

J826—43 plate .001 Mfd. Price.....$4.95

The latest improvement in condensers consists of regular variable condenser controlled by large knob and dial. Separate small knob mounted above dial controls a three plate vernier condenser. This arrangement permits of very fine tuning. High grade design and construction. Finely finished. Suitable for table or panel mounting.

ENCLOSED VARIABLE CONDENSER

One of the best made condensers. Rigid, accurately spaced aluminum plates. Formica ends. Engraved scale. Knob and pointer. Clear transparent case.

J806—43 plate .001 Mfd.....$3.95

J808—21 plate .0005 Mfd.....$3.25

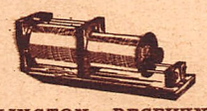
KNOCKED DOWN VARIABLE CONDENSERS

You can save money by assembling your own condensers. Formica top and base. Complete with all parts not assembled. Go together easily and perfectly. Panel mounting type.

J820—41 Plate .001 Mfd.....$2.48

J281—21 Plate .0005 Mfd.....1.88

RADIO GOODS—BEST QUALITY—REDUCED PRICES



ARLINGTON RECEIVING TRANSFORMER

Will tune in all stations up to 3,500 meters. Very efficient on short waves and for radiophone reception. Used with our Detector Two Step Amplifier it produces very excellent results. Also does good work with crystal detector. Silk covered windings on formica tubes. Very fine mahogany finish wood work. Base size 6x18 inches. Slider controls primary, 12 point switch on secondary. Can be tuned very close. A wonderful value at our price.

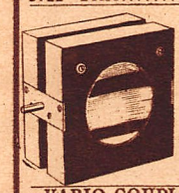
J720 Price..... $6.95

TUNING COIL

Range up to 950 meters. Wound with bare copper wire, machine spaced. Ends of mahogany finished hard wood. Two easy sliding contacts on polished brass rods, four binding posts. Substantial, efficient, attractive. Length, 8¾ in.

J722 Price..... $2.45

VARIOMETER



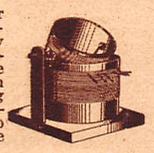
J410—Completely assembled, price $2.97

J411 Not assembled but all parts complete, including winding form, $1.90

Perfect in design and construction. Accurate wood forms. Correct inductive ratios. Solid baked windings. Positive contacts. Highest efficiency.

VARIO-COUPLER

With this loose coupler and two variometers, together with the necessary other parts, a highly efficient tuning set can be made. Easily mounted on panel. Primary winding on formica tube. Inductively coupled for 180 to 600 meters. Multiple taps permit fine tuning.

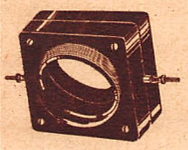


J415 Price, completely assembled..... $2.95

J416 Not assembled but all parts complete. Price..... $1.35

J417 Rotor ball only. Each..... 29c

MOULDED VARIOMETER



Polished black moulded rotor and stator forms. Maximum inductance with greatest efficiency and minimum distributed capacity. A high grade durable instrument that will make up into a set you will be proud of and will get the best results. Wave length 180 to 600 meters. 4¼" square. 1⅛" thick. Shaft threaded 8–32.

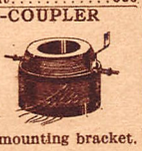
J412 Price..... $4.35

J413 Brackets for panel mounting, pair.. 29c

J912—3" Dial and knob to fit..... 65c

MOULDED VARIO-COUPLER

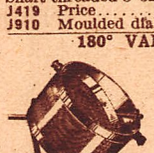
This coupler is designed to work with the above variometer. The stator and rotor forms are of polished black moulded composition. Primary has seven taps to enable finest tuning. Wave length range 180 to 650 meters. Fitted with panel mounting bracket. Shaft threaded 8–32.



J419 Price..... $4.25

J910 Moulded dial with 90° scale to fit.. 65c

180° VARIO-COUPLER



J418 Price..... $3.90

The most efficient type of coupler. Insures sharper tuning and louder signals. Primary and secondary wound on genuine bakelite tubes. Secondary connections through soldered flexible cables eliminates contact noises. Primary has 7 taps. Can be panel or table mounted. Range 180 to 650 meters.

BRASS ROD

Supplied only in 12 inch lengths.

J961 Threaded 6–32, per length..... 8c

J963 Threaded 8–32, per length..... 10c

J965 Solid 3–16 inch, per length..... 10c

J967 Solid ¼ inch, per length..... 12c

SPAGHETTI

For covering connecting wires in sets. For size 12 and 14 wires.

J955 Finest quality braided and saturated with best baked lustrous transparent insulating varnish, 3 feet for..... 29c

J956 Best quality braid and covered with good grade insulating compound, 3 feet for..... 12c

PARTS FOR ARMSTRONG SUPER REGENERATIVE CIRCUIT

J355 100 Millihenrie Iron core choke coil. Each..... $1.20

J354 10 Millihenrie Open core choke coil. Each..... 92c

J357 12,000 ohm Non-Inductive wire wound resistance. Each..... $1.58

J356 12,000 ohm Moulded resistance. Each..... 45c

J358 5 Millihenrie Open core choke coil. Each..... 92c

J359 1 Henrie Iron core, choke coil, Each..... $1.20

FIBER TUBES

Fiber tubes for winding coils. Strong solid material.

J950 Diameter 3 inches, per foot..... 20c

J951 Diameter 3½ inches, per foot..... 25c

J952 Diameter 4 inches, per foot..... 30c

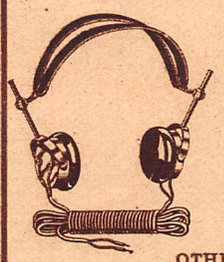
EVERYTHING FOR THE COMPLETE SET

PRESERVE THESE PAGES

ORDER FROM THEM AND SAVE MONEY

FAST SERVICE—TRY US AND BE CONVINCED

THE PRICES QUOTED DELIVER THE GOODS TO YOUR DOOR



BARAWIK QUALITY HEADSETS

These headsets have proven on rigid tests to be one of the very best on the market. The tone quality is excellent with an unusual volume. Skilled workmen make them from only the best selected materials. The receiver cases are brass in fine polished nickel finish. Polished black ear pieces. Fabric covered head band comfortably and quickly fitted to the head. Supplied with 5-foot cord. These sets were designed to sell for $8.00 and $9.00 each and at our price are a wonderful bargain. We guarantee that you will be pleased with them and agree that they are the best value by far yet offered. If they don't suit you we will cheerfully return your money.

J770—2000 ohm.... $4.00 J772—3000 ohm.... $5.00

OTHER STANDARD BRAND HEADSETS

J751 Murdock 56, 2000 ohm..... $4.45

J752 Murdock 56, 3000 ohm..... 5.40

J764 Frost, 2000 ohm..... 4.45

J766 Frost, 3000 ohm..... 5.40

J756 Red Head, 3000 ohm..... 5.85

J758 Western Electric, 2200 ohm.... 10.80

J754 Baldwin Type C with universal jack plug..... $16.00

J755 Baldwin Type C unit with attaching cord..... $7.75

J768 Brandes, 2000 ohm..... 7.20

J769 Holzer-Cabot, 2200 ohm..... 7.20

J770 Kellogg, 2400 ohm..... 9.75

ENCLOSED DETECTOR

One of the finest crystal detectors on the market. Supersensitive galena crystal enclosed in heavy glass shield. Quick, positive adjustment. Brass parts polished nickel finish.

J730 Each..... $1.48

GALENA DETECTOR

Easy fine adjustment. Crystal mounted in cup. Moulded base and knob. Brass parts polished nickel finish.

J732 Each..... 89c

DETECTOR CRYSTALS CAREFULLY TESTED

J736 Galena, Arlington tested, per piece.. 19c

J738 Silicon, Arlington tested, per piece.. 19c

J735 Buzzer tested, Galena, per piece.... 12c

J737 Buzzer tested, Silicon, per piece.... 12c

DETECTOR PARTS

J725 Price set.. 32c

All metal parts for crystal detector. No base included. Easily assembled. Polished nickel finish.

J727 Detector Crystal Cup. Each..... 6c

J728 Cat Whisker Wire, 5 feet for..... 5c

BAKELITE DIAL AND KNOB

Neat, clean cut design. Clear, plain engraved scale, with enameled white letters contrasting with polished black finish of dial. Fluted knob. Diameter three inches.

J902—For 3–16 inch shaft. Each 89c Dozen $7.20

J903—For ¼ inch shaft. Each 69c Dozen $7.20

Same design Dial and Knob but made of polished black composition. Looks just as well as the bakelite when new but does not retain finish as well and is more fragile.

J908—Three inch 3–16" shaft. } Each 30c

J909—Three inch ¼" shaft... } Dozen $3.00

ONE PIECE DIAL AND KNOB

A fine looking knob and dial moulded in one piece. Neat clean cut design. Polished black finish. Clear plain engraved scale with numbers and lines in contrasting white enamel. Ribbed knob that fits the hand. The three sizes used on the same panel can be arranged to produce a very attractive effect.

Three and four inch sizes are marked 0 to 100 over 180° of the scale. 2¼ inch size is marked 0 to 9 over 270° of scale.

J900—2¼ in. Diam. for 3–16in. shaft. Each, 45c

J901—2¼ in. Diam. for ¼ in. shaft. Each, 45c

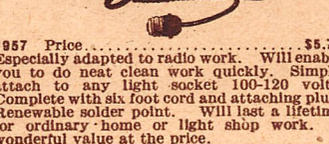
J904—3in. Diam. for 3–16in. shaft. Each, 45c

J905—3in. Diam. for ¼ in. shaft. Each, 45c

J906—4in. Diam. for 3–16in. shaft. Each, 75c

J907—4in. Diam. for ¼ in. shaft. Each, 75c

ELECTRIC SOLDERING IRON



J957 Price..... $5.75

Especially adapted to radio work. Will enable you to do neat clean work quickly. Simply attach to any light socket 100-120 volts. Complete with six foot cord and attaching plug. Renewable solder point. Will last a lifetime for ordinary home or light shop work. A wonderful value at the price.

ROSIN CORE SOLDER

J958 Per Coil..... 22c

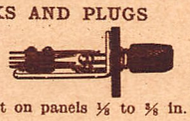
Self fluxing. Especially designed for soldering electrical connections. Fine for use with above electric iron. Coil will last a long time.

TINOL

J959 Per tube..... 22c

With this preparation you can solder your connections with the heat of a match. Works fast. Makes a perfect electrical and mechanical joint. Self fluxing.

RADIO JACKS AND PLUGS



Finest grade jacks. Improved design. Best materials. Phosphor bronze springs. Silver contact points. Nickel finish. Mount on panels ⅛ to ⅜ in. thick.

Jacks Only

J390 Open circuit. Each..... 45c

J391 Closed circuit. Each..... 52c

J392 Two circuit. Each..... 63c

J393 Single cir. fila. control..... 70c

J394 Two cir. fila. control..... 88c

J395 Plug. Large space with set screws for attaching cord. Each..... 78c

COMPETITOR JACK AND PLUG

Well made, durable, smooth working. Interchangeable with any standard Jacks and Plugs. Solder connections. Nickel finished metal parts. Fiber barrel on Plug.

J388 Two Circuit Jack. Each..... 48c

J389 Standard Plug. Each..... 48c

STANDARD FLAT PLUG

J398 Each..... 74c

Black polished case with polished nickel insert. Fits any standard jack. Quick solid connections.

THREE-WAY ROUND PLUG

J397 Each..... 98c

Takes three pairs of head set terminals. Quick easy connections. Polished round barrel. Fits any standard jack.

BINDING POSTS

Brass, polished nickel finish. Washer and 6–32" screw extending ⅜". Order by Article Number.

J360 Large size—barrel and knob ¾" long, dozen..... 95c

J372 Smaller size—barrel and knob 9–16" long, dozen..... 84c

J374 Large size with composition knob, dozen..... 50c

J376 Large size with hole for phone tip or wire, dozen..... 95c

J378 Small size with hole for phone tip or wire, dozen..... 38c

SWITCH CONTACT POINTS

Brass, polished nickel finish. All have ⅜" long size 6–32 screws. All prices the same.

Dozen 20c Hundred $1.40

Order by Article Number.

J360 Head, ¼": Diam., ¼" High

J362 Head, 3–16": Diam., ¼" High

J363 Head, 3–16": Diam., 1–16" High

Solder Lugs to Fit Contact Points

J385 Dozen 12c—Hundred 60c

SWITCH LEVERS

Moulded composition knob. Exposed metal parts polished. nickel finish. Fitted with panel bushing, spring and two set nuts. A high grade switch.

J380—1" Radius.... } Each

J381—1¼" Radius.... } 22c

J382—1½" Radius.... }

SWITCH LEVER STOP

Brass, polished nickel finish.

J386—Dozen 20c, Hundred $1.40

LONG NOSE PLIERS

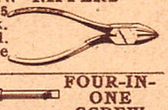
J970 Price.... $1.25

The handiest pliers for radio work. Made of fine hardened steel. Length 5 inches. Fine clean finish.

DIAGONAL JAW NIPPERS

J972 Price..... $1.25

For fine electrical work. Made of hardened steel. Length 5 inches. Fine clean finish.

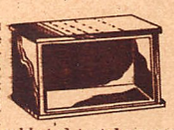


FOUR-IN-ONE SCREW DRIVER

J974 Each..... 55c

Especially suitable for radio work. Will handle any size screw used. Smaller drivers nest inside larger one and are held in place with screw cap. Made of steel, nickel finished.

CABINETS



Fine looking cabinets solidly built. Made of genuine solid mahogany in elegant hand rubbed finish. You will be proud of your set mounted in one of these cabinets. Hinged tops. Front rabbeted to take panels. Panels not included. Prices are transportation paid.

Panel Size	Inside Dimensions High	Wide	Deep	Art. No.	Price Each
6x 7"	5½"	6½"	7"	J420	$2.48
6x10½"	5½"	10"	7"	J422	2.75
6x14"	5½"	13½"	7"	J424	3.30
7x14"	6½"	13½"	7"	J423	3.60
7x18"	6½"	17½"	7"	J426	3.90
6x21"	5½"	20½"	7"	J425	3.90
9x14"	8½"	13½"	10"	J428	3.70
12x14"	11½"	13½"	10"	J430	4.40
12x21"	11½"	20½"	10"	J432	5.25

SOLID GENUINE CONDENSITE CELORON PANELS

Notice our very low prices on this fine quality grade 10 genuine solid sheet Condensite Celeron (a product with mechanical, chemical and electrical properties like formica and bakelite). Machines well without chipping. Won't warp. Waterproof. Highest mechanical and di-electric strength. Attractive natural polished. Black finish which can be sanded and oiled for extra fine work.

Panel Size Inches	⅛" thick Art. No.	Price	3–16" thick Art. No.	Price	¼" thick Art. No.	Price
6x 7	J450	$0.50	J460	$0.75	J470	$0.98
6x10½	J451	.75	J461	1.18	J470	1.47
6x14	J452	1.05	J462	1.55	J472	2.05
7x14	J458	1.20	J468	2.60	J478	2.40
7x18	J453	1.55	J463	2.30	J473	3.10
7x21	J457	1.76	J467	2.65	J477	3.60
9x14	J454	1.60	J464	2.30	J474	3.10
12x14	J455	2.10	J465	3.10	J475	4.15
12x21	J456	3.15	J466	4.65	J476	6.20

TRANSFER PANEL MARKERS

J501 Per set..... 27c

A complete set of decalcomonia trasfer markers that can be quickly and easily applied to any part of any panel to mark binding posts, dials, knobs, etc. Very attractively lettered words on neat gold background. Following captions included.

Aerial	Coupling	B Battery
Pri. Condenser	Detector	Loading coil
Sec. Condenser	1st Step	On.... Off
Ground	2nd Step	(3) Increase
Primary	3rd Step	(2) + (2) —
Secondary	Input	A G
Plate Var.	Output	A Battery
Grid Var.	Phones	Tickler

ETCHED METAL NAME PLATES

Made of brass. Silver plated characters and border on black background. All plates are 1 inch long and ⅜ inch wide, except "INCREASE CURRENT" which are quarter circle 1⅜ inch over all, and "ON" "OFF" which are ⅝ inch long. Attaching holes pierced.

J503 Per Dozen..... 35c

Not less than one dozen assorted sold. Specify marking wanted as follows:—

Plate Variometer	Secondary	Aerial
Grid Variometer	Primary	Ground
Vacuum Tube	Tickler	Phones
Primary Condenser	Load'g Coil	Input
Secondary Condenser	Coupling	Output
Increase Current (to right)	Parallel	On
	Series	Off
Increase Current (to left)	Detector	1st Step
	A Battery	2nd Step
	B Battery	3rd Step

(Blank—takes pencil or pen marks.)

MAGNET WIRE

Insulated copper wire. Best quality even drawn wire, one piece to a spool. Prices quoted are for 8 oz. spools.

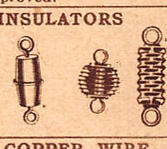
Double Cotton Covered Insulation Number J990		Enameled Insulation Number J992	
Gauge	Price	Gauge	Price
18	50c	20	45c
20	60c	22	55c
22	75c	24	61c
24	85c	26	65c
26	95c	30	70c
28	$1.15	32	76c
30	1.65	36	98c

OUTDOOR LIGHTNING ARRESTER

J980 Price..... $1.68

Protect your instruments with this lightning arrester You cannot afford not to. Weatherproof porcelain case. Air gap type. Permanent. Durable. The most practical quality arrester obtainable. Underwriters approved.

ANTENNA INSULATORS



J260 Size 1x3¼. Two for..... 19c

J262 Size 2⅛x3¼. Two for..... 58c

J264 Size 1½ x 4. Two for..... 80c

J266 Size 1½x10½. Two for..... $1.35

SOLID BARE COPPER WIRE

Solid bare copper wire for aerials, leads or wiring instruments.

Solid Bare Copper Wire, size 14

J240—100 ft. coil 45c J242—500 ft. coil $2.15

Solid Bare Copper Wire, size 12

J244—100 ft. coil 61c J249—500 ft. coil $2.75

STRANDED ANTENNA WIRE

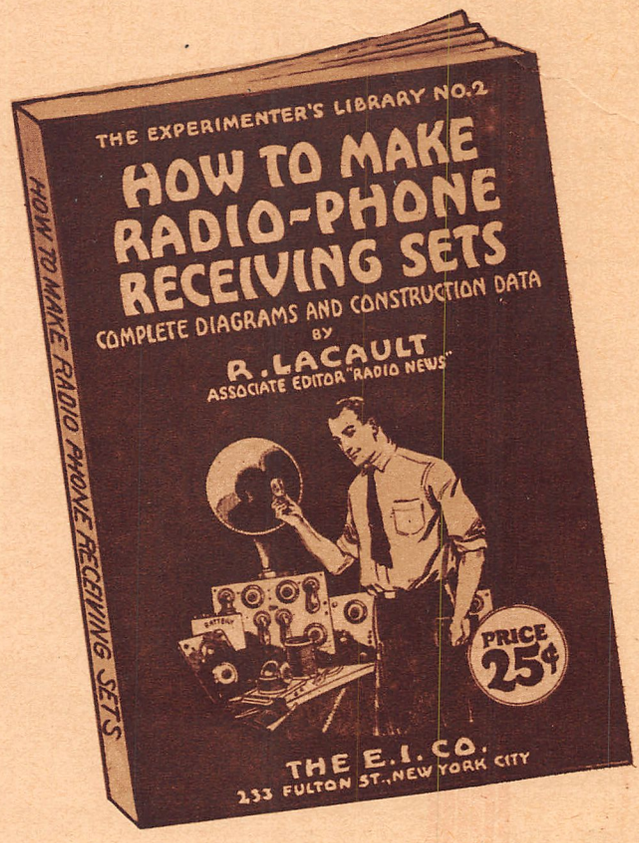
Cabled of fine copper strands. Very flexible. High tensile strength. Best for aerials.

J248—100 ft. coil 85c J249—500 ft. coil $2.95

THE BARAWIK CO. 102 South Canal Street, CHICAGO, ILL.

Two New Ones for the Amateur

Your Choice 25c Postpaid



HOW TO MAKE A RADIO-PHONE RECEIVING SET

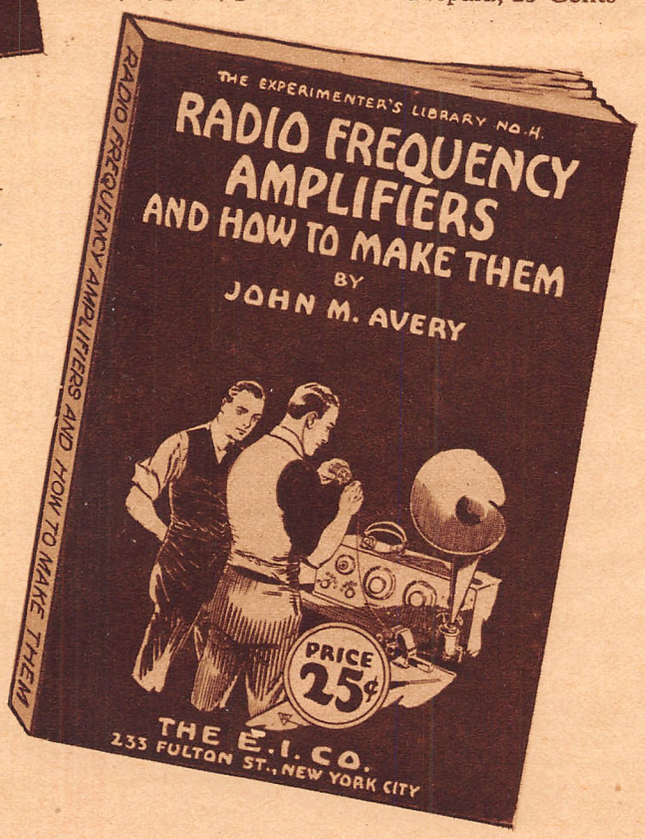
By

ROBERT E. LACAULT

Associate Editor RADIO NEWS

A NON-TECHNICAL book for the beginner. Gives complete constructional data on the building of a complete Crystal Detector Set, Tuning Coil, Loose Coupler and a Single Audion Tube Set with Amplifying Units. It furnishes all dimensions and working drawings of every part that must be constructed by the amateur. Written in plain, simple language that anyone can understand. The opening chapter gives a complete description of the theory of radio and tells what it's all about, teaching the principles of wireless so that the constructor knows what he is doing.

48 Pages, 26 Illustrations
Bound in Beautiful Two-Color Cover
Size, 5½ x 7½ inches Prepaid, 25 Cents



RADIO FREQUENCY AMPLIFIERS

AND HOW TO MAKE THEM

By

JOHN M. AVERY

THIS book is for the more advanced amateur, showing the construction of the Radio Frequency Amplifying Transformer and giving complete constructional data. It shows the application of Radio Frequency to amplifying units that the amateur may already possess and gives 15 hook-ups showing practically every use Radio Frequency Amplifying Transformers can be put to.

32 Pages, 15 Illustrations
Bound in Beautiful Two-Color Cover
Size, 5½ x 7½ inches Prepaid, 25 Cents

THE E. I. COMPANY

233 FULTON STREET
NEW YORK CITY, N.Y.

(*Continued from page* 708)

After squaring it up and allowing it to dry thoroughly, scrape the tinfoil away from all the holes so that the shafts and connections will not short. If you wish, and it would be a good idea, get a sheet of cambric (empire) insulating cloth, cut it to the same dimensions as the tinfoil and shellac it over the foil. This will eliminate the crude appearance of the tinfoil and lessen the danger of shortage. Cambric sheeting is rather difficult to obtain, although it is a very handy article to have about the station.

ASSEMBLING

Mounting the apparatus is the next consideration. The variable condensers should be securely attached to the panel, using flat-headed nickeled screws, which are generally supplied with each instrument. The smaller condenser of twenty-three plates occupies the center space, with the two forty-three plate condensers at either side. The vacuum tube socket is mounted in a novel manner; the bakelite end piece of the twenty-three plate condenser serves as a special sub panel. It will be necessary to drill two holes in this end plate, to which the socket is firmly held with two machine screws. The filament switch is the ordinary single-gang switch. It will be found useful as it saves wear on the filament rheostat. It is better also, as it allows the filament to light instantly, thereby prolonging its life. This switch is located at the top, center, the audion peep hole being directly below. If a large sized drill is not available, the hole for the switch should be made by drilling a ring of small holes and knocking out the center.

The sub panel is mounted flush up against the main panel near the top. Cut two pieces of hard wood two inches long by one-half inch square and fasten them to each edge of the sub panel with machine screws, using the two holes at either end as shown in Fig. 1. The sub panel, in turn, is held to the main panel by two flat-headed wood screws, nickeled, one inch long. Finally, place the dials and knobs on the shafts. When the zero mark on the dial and the indicating mark on the panel are in line the movable elements of the condenser should be all the way out; i. e., the least value of capacity.

WIRING

The last step toward the completed instrument is the wiring. The terminals on the sub panel may be ordinary six thirty-second machine screws, or regular binding posts. There are twenty of them on this sub panel. Six are connected to the posts of the three condensers, six to the coil mounting, four to the vacuum tube socket and two each to switch and rheostat. Use No. 18 hard drawn copper wire for connecting the instruments to the sub panel. Run the wire in cambric tubing, keeping the leads as far as possible from the panel. Be very sure that these connections are good. Solder all of them and make a good mechanical connection besides. One loose connection will give an extraordinary amount of trouble. Make them as short as convenient. If the wire is run up against the panel, the tinfoil, being so close, will introduce objectionable capacity effects.

SUPPORT

The panel may be mounted by means of brass angle braces or set in a suitable sized cabinet. Whichever method is used some means of keeping out the dust should be provided. If a cabinet is used the leads from the aerial, ground and other exterior parts may be brought to the sub panel by drilling a few quarter-inch holes in the back near the top and bringing the leads in through them. This places all exterior connections out of sight. Room has been left on the panel for either angle brass or cabinet mounting.

If all the Manhattan Radio Headsets that have been manufactured and sold since the first one was produced on March 20th, 1922, were placed side by side, they would stretch in an unbroken line eleven miles long.

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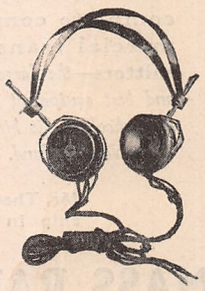

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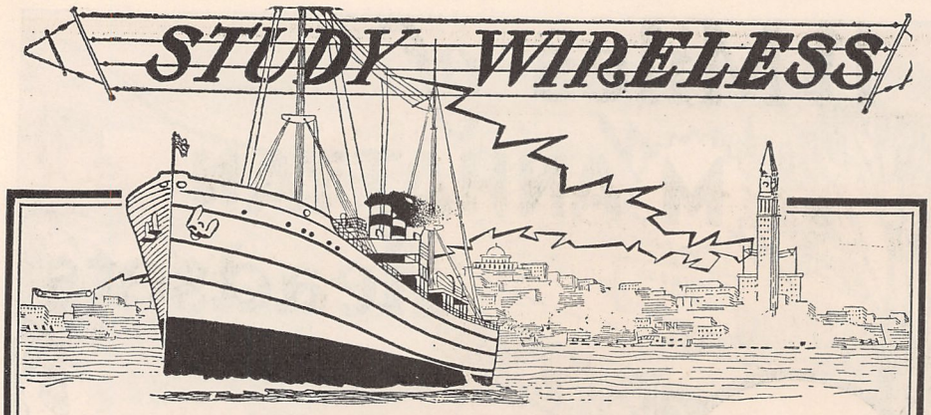

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SHORT WAVE COILS

The only parts actually home made are the coils for short wave reception. Four will be necessary for the band of wave lengths from 200 to 800 meters, using either single or double circuit. The forms may be made of stiff cardboard tubing, one inch wide and three to four inches in diameter. Give each a good coat of shellac and let them dry. If necessary, a few more coats may be applied to give them the necessary stiffness. Bakelite or micarta tubing will be better and make a nicer job. Near the edge of each coil drill a small hole, to which the wire is to be fastened. One coil is twenty turns, the others thirty, forty and sixty. Wind the wire on evenly and tightly. The twenty turn coil is wound with No. 20 double cotton covered, the thirty turn coil with No. 24 D. C. C., the forty turn one with No. 26 D. C. C., the sixty turn coil with No. 32 D. C. C. The wire may be given a very light coat of shellac or, better still, a coat of collodion, which may be purchased in the drug store. If neither shellac nor collodion is used, it will be necessary to band the coil at regular intervals with silk thread to prevent the wire from slipping off the form. The last method is to be preferred. Make each coil alike in the direction of winding and when mounting them on the coil plugs be sure that the connections are similar; i. e., that each coil is poled the same as every other. Attach the coils to plugs with some form of tough strap. If any of the cambric sheeting is left it will serve. Regular straps may be purchased or stiff glazed manila paper or sheet celluloid will answer the purpose. Solder the leads to the plug and make the strap firm so that the coil will stand some knocking about. For waves above 800 meters multilayer coils may be made with taps. Only a few will be necessary to cover the entire range.

ACCESSORIES

It is very unworkmanlike to leave the coils scattered about the table and floor and not conducive to their long life to have them stepped on. Therefore a small but necessary accessory is a coil rack. This rack should be mounted on the wall in a convenient position. The simplest type of rack consists of a piece of wood a foot long, three inches wide and an inch thick. On a line one inch from the top drill a series of holes one and one-quarter inch apart. The holes should be just big enough to tightly hold the plug. Fig. 2 makes everything clear.

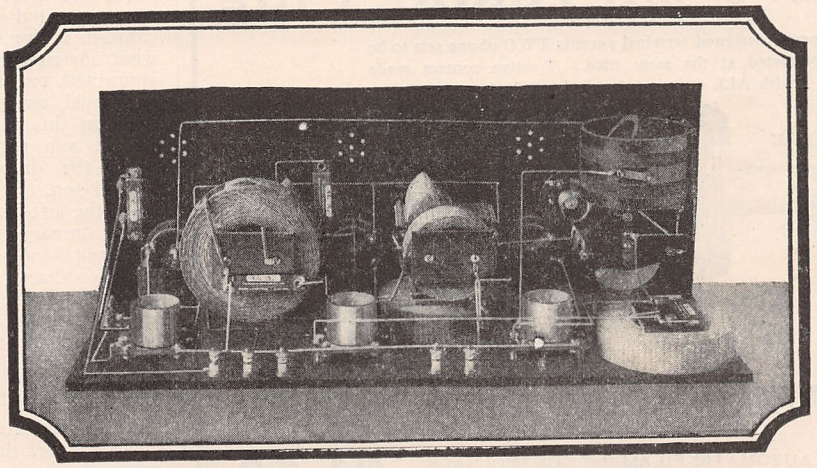
The storage battery has to be charged and the cheapest and best way is to do this at the owner's station. Fig. 3 gives the correct hook-up for charging with D. C. If only alternating current is available it will be necessary to buy a rectifier. The rectifier can be either mechanical or the Tungar type. Fig. 4 shows the proper connections. This switching method is fool proof and there will never be any danger of blowing the bulbs or burning the set. Use No. 14 rubber covered wire and the ordinary battery double pole, double throw switch.

The aerial for this set, if one is not already erected, should consist of a single wire from 75 to 150 feet in length. The lead should be taken off at one end and soldered. The lead-in wire may be the same as the aerial, No. 14 copper or copper-clad.

The phones are connected to a phone block, consisting of a piece of bakelite and a pair of binding posts, or two pairs, if more than one headset is to be used. The telephone block should be screwed to the left-hand side of the operating table. The cord will then be out of the way when tuning. The connections from the block to the sub panel can be made with bell wire.

TUNING

Assuming that the set is complete, the aerial erected and the extras on hand—wire



Opening a *new* and *absorbing* field *for* radio exploration—

THE Armstrong Super-regenerative Circuit opens a great new field for radio exploration and valuable experimentation. This circuit is sufficiently complicated beyond that of the ordinary hook-up to whet the appetite of the radio amateur. Experimentation has already shown this circuit to afford almost limitless possibilities for development by radio enthusiasts. Who knows but that you, yourself, may be the one to hit on the next great step forward!

Here is the way to start. The Sleeper Radio Corporation, makers of the many Sleeper Construction Sets, has just completed the successful development of a set embodying the super-regenerative circuit that can be built in the home workshop. By constructing this receiver yourself from the specially designed and selected parts you gain the fundamental knowledge necessary before commencing your own experimentations. This set was designed by M. B. Sleeper, Editor of "Radio and Model Engineering" published by the Sleeper Radio Corporation. Included with the set are clear, concise specially-prepared instructions. You can build this Sleeper Construction Set for a fraction of the cost of a finished set.

The only tools you need are pliers, screw driver and soldering iron. The set includes a small loop antenna to replace the cumbersome outdoor aerial—just one example of its many advanced features This new Sleeper Construction Set is now on sale at most radio and electrical stores. If your dealer has not already been supplied send us his name and we shall be glad to supply you both with further interesting information. Ask also for complete catalog of Sleeper Radio Products. THE SLEEPER RADIO CORPORATION, Dept. 9, 88 Park Place, New York City.

Sleeper Radio Construction Set—Type 3,000

PRICE $59.65. The super-regenerative receiver. A construction set which promises to revolutionize short wave reception. Consists of special vario-coupler, completely assembled; special high resistance units, four concentrated inductances, three variable condensers, a vernier condenser, panels drilled and engraved and all necessary incidental parts. Packed complete with instructions in neat display box. *Ask your dealer.*

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Carter *TU-WAY* Radio Plug

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Special designed terminal permits TWO phone sets to be connected at the same time. Positive contact made with ALL types of tip cord terminals or wires.

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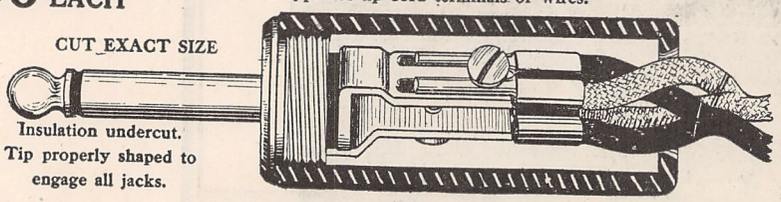

Insulation undercut. Tip properly shaped to engage all jacks.

Black finish, non-breakable, round, one piece handle not affected by body capacity; no screws used to hold handle in place.

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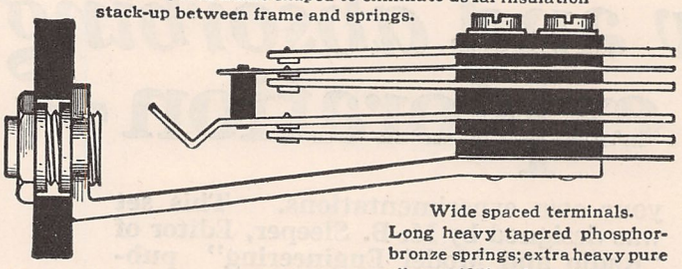
Wide tapered frame shaped to eliminate usual insulation stack-up between frame and springs.



Other Combinations, 1 to 4 Springs, **70c to $1.00 EACH**

Wide spaced terminals. Long heavy tapered phosphor-bronze springs; extra heavy pure silver self-cleaning contacts.

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up the sub panel to the circuit of the usual three coil mounting in Fig. 5 and the set is ready for a trial. The sub panel terminals are connected with No. 18 copper run in cambric tubing. It is easy to remember to what instrument each pair of terminals is connected, but, to be sure, either engrave the sub panel, use the small name plates advertised in this magazine or make a drawing of the sub panel, label the terminals and paste the drawing on the inside of the hinged top. When the circuit in Fig. 5 is used, the left-hand coil socket is the primary, the stationary socket is the secondary and the right-hand socket is the tickler. The left-hand condenser is the primary, the center condenser is the variable grid condenser and the right-hand condenser is the secondary condenser. By this arrangement the controls most used are placed nearest the right hand. Insert a twenty turn coil in the primary socket, a thirty turn coil in the secondary and the sixty turn coil in the tickler socket.

Now insert the bulb, making sure that the prongs of the tube socket make positive contact with the studs. Turn the rheostat knob, decreasing resistance till the tube lights brightly, and some sign of life is heard in the phones. Bring the primary coil close to the secondary, place the tickler at a thirty degree angle to the secondary and place the variable grid condenser (center) at about one hundred degrees. Now move both primary and secondary condensers.

Let us suppose that a faint phone station is heard, move both primary and secondary condensers till the loudest signal is obtained. Light the bulb still brighter, but not enough to distort the voice. Vary the tickler coupling, and at the same time the secondary condenser, in order to keep the station in tune. Now, when the station is loudest decrease the primary coupling, and turn the primary condenser. Readjust the primary coupling. Only when the station is as loud as possible should the rheostat and grid condenser be touched. Move both till maximum response is had in the phones. You will see that the tickler and secondary condenser are used most and that is the reason why they are at the right-hand side of the panel. If spark stations are heard, proceed in the general manner indicated above, but conclude by varying the primary and tickler coupling and secondary condenser. If the receiver does not oscillate reverse the tickler leads. This circuit is typical of the ordinary receiver and after a little experience the knack of adjusting the controls will become second nature to the operator. It is not the purpose of this article to give a list and description of all the circuits which may be used on this receiver. Buy a good book on vacuum tube circuits and find the relative merits of each one by actual trial. A few may be found in this issue and back copies contain descriptions of nearly all of them. The newest of Armstrong circuits, or any other one which calls for more apparatus, will necessitate the construction of another panel the same height as the one described and equipped with a terminal sub panel also. Connections from one sub panel to another can be done neatly. Fixed condensers are introduced to the set by wiring them in at the sub panel. The grid leak can be drawn directly across the terminals on the sub panel. Equip the vacuum tube with fuses. Only after blowing out a few perfectly good tubes can the importance of this last statement be fully appreciated.

CONCLUSION

The cost of such a set is very low when the results are considered. Very little work is required, as there are no movable home-made parts to bother with. Calculating from prices advertised in a daily paper the set without extras should cost no more than $25. The extras mount up to $30 more, and if a rectifier is needed add $15. So the set complete will cost either $55 or $70 at the most.

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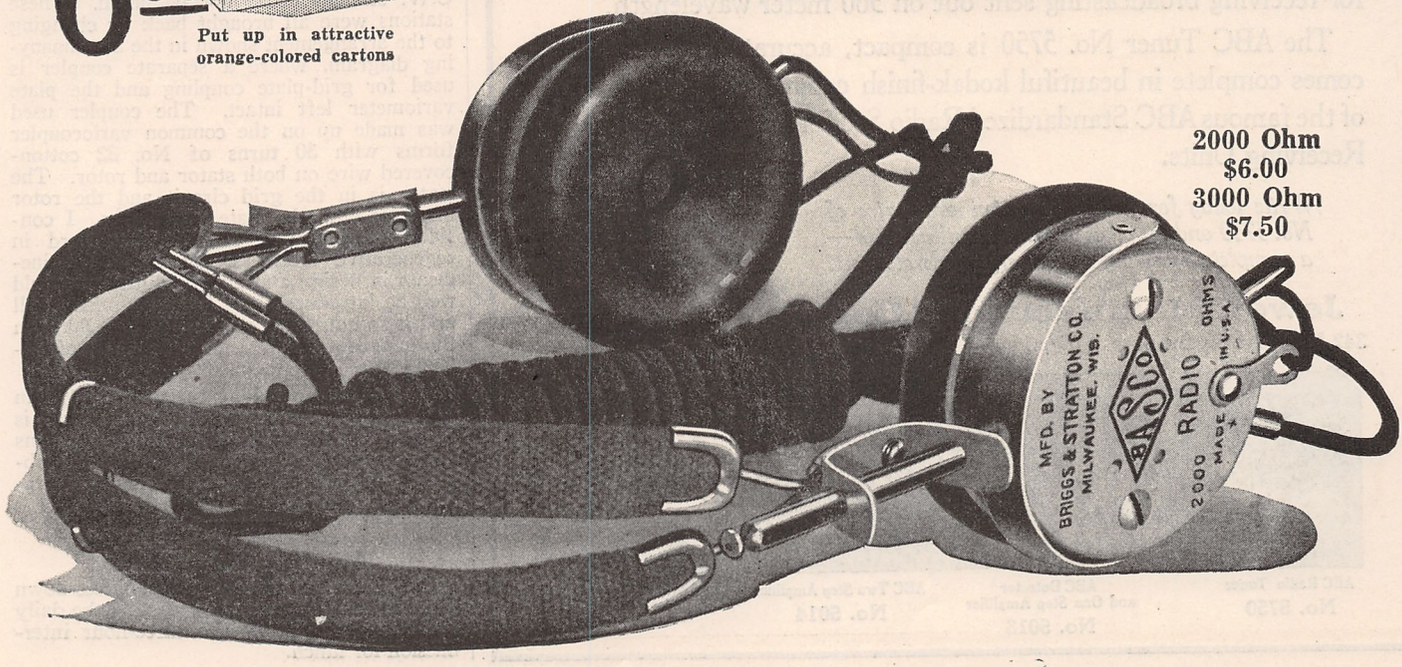

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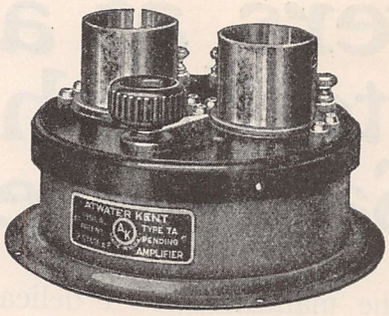

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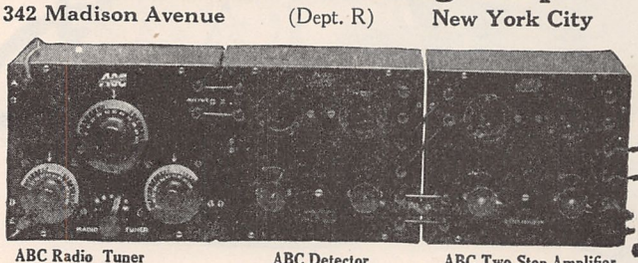

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ABC Radio Tuner No. 5750

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This set will certainly give the utmost satisfaction if made fairly close to specifications. As an all-round receiver it is unexcelled and has the added advantage of containing many circuits in one set.

That Short Wave Set

(*Continued from page* 648)

them very crude in construction, it seemed to be up to me to junk the old short wave set and build something new.

While planning the new set it occurred to me that all such sets differed from the conventional three-circuit tuner in having a direct inductive coupling between the plate and grid circuits. In other respects they varied widely and it was difficult to select the best arrangement. I never did decide which one to built but instead of simplifying my circuit, I complicated it.

It is hardly necessary to state that tone quality, selectivity and relief from static are attained to a greater degree with three-tuned circuits than with the simpler arrangements, and the addition of means for coupling the grid and plate circuits has proved to provide what the conventional three-circuit tuner lacks, stability and ease in tuning. Of course considerably more time is consumed in tuning the three-circuit set when first put in operation, but this has never been a serious matter if results could later be duplicated using the same adjustments for the same stations. This has been found possible with the set stabilized by direct feedback coupling, while in the ordinary three-circuit tuner adjustments for good phone reception vary from day to day.

The first means of coupling which was devised consisted in splitting up the plate variometer stator winding into two halves. One half was left in the plate circuit and the other connected in series with the secondary of the variocoupler and grid variometer. The operation of the set connected in this way proved that the coupling provided was a decided stabilizer—or, in other words, that the idea was good. Stations were tuned in with practically the same adjustments day after day; the set remained in operation without further adjustment for as long as desired, and the tone quality was equal to the best results obtained with the usual connections.

Two of the broadcasting stations regularly heard, however, and many familiar amateur C.W. stations could not be heard. These stations were all brought back by changing to the arrangement shown in the accompanying diagram, where a separate coupler is used for grid-plate coupling and the plate variometer left intact. The coupler used was made up on the common variocoupler forms with 30 turns of No. 22 cotton-covered wire on both stator and rotor. The stator is in the grid circuit and the rotor in series with the plate variometer. I consider the resulting set the last word in regenerative receivers, barring the refinements in design and manufacture that could well be introduced, and I believe others will find it so until they are able to bid Old Man Static farewell with a loop and R. F. amplifiers.

The coupler used in this set is 3½" in diameter and the stator is 4" long, but it is obvious that slight changes in dimensions and winding will not affect the results obtained, as both circuits concerned are separately tuned.

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One of the best ways to get Congress down to business is to start broadcasting the daily proceedings, including the three-hour intermission for lunch.

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ALL AMERICAN

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Bulletin 22-B
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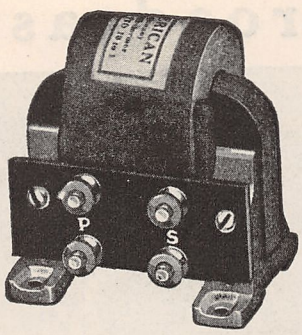

Audio Frequency
Type R-2—ratio 3 to 1
$4.25
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The MOON is made of heavy aluminum, highly polished and built to last a lifetime. The horn is seamless, spun like silverware all in one piece, 10½ inches in length. The complete instrument stands 15½ inches high. To own one solves the Radio Home Concert Problem

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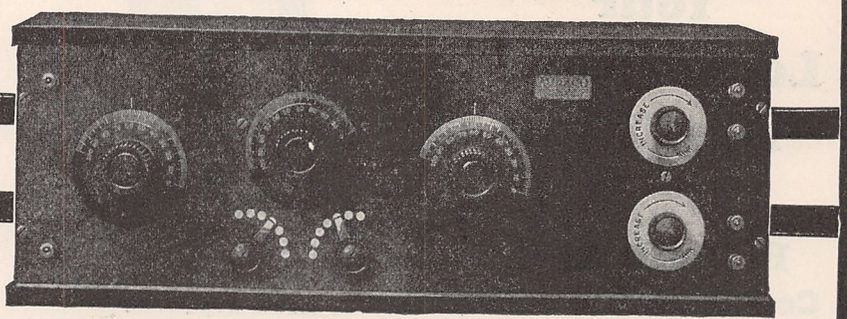

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Send for literature descriptive of this and other "MIRACO" Products.

MIDWEST RADIO CO.

804 MAIN STREET, CINCINNATI, OHIO

The Construction of a Loop

(*Continued from page* 653)

wooden parts a thorough coat of good varnish is necessary. Glue may be used for assembling the supports, hub and spreaders.

When the frame is dry and entirely finished, the wire should be wound on. Either No. 22 (the smallest allowable), No. 20, 18, or larger copper, copper clad or stranded wire should be used. As most dealers stock the even number sizes in copper wire there should be no difficulty in securing same. Fasten one end of the wire to a binding post on the bottom spreader and, with care, proceed to wind the ten turns on the frame. The wire must be stretched taut enough to prevent slack. A space is to be left at the center, as shown, for the revolving shaft.

While no stand is shown, it is desirable to use one. It should be made to match the frame and should be capable of a 360-degree rotary movement. An old flywheel from a sewing machine used as a control wheel and a large 360-degree dial will finish the unit.

Clips may be used to vary the inductance. In actual operation, the loop is connected to the grid and filament, or input terminals, of the detector with a 23-plate variable condenser shunted across it. A variometer may be used in the plate circuit for regeneration or three connections may be taken from the loop. One connection goes to the grid condenser, the central connection to the negative side of the "A" battery and the third tap to the negative side of the "B" battery, the positive side of the "B" battery going through the phones to the plate. Shunt a .001 M. F. condenser across the phones and "B" battery. The tap going to the "A" battery regulates regeneration. This loop will work well with one or two stages of radio-frequency amplification. It is to be recommended for use with the Armstrong super-regenerative circuit. Unsatisfactory results will be obtained if a crystal detector is used without amplification.

It is sometimes possible to increase the signal strength by connecting the ground to either the "A" battery or a section of the loop. If a high-powered spark station is located in the immediate vicinity, a good method which will greatly reduce, if not entirely eliminate interference, is to erect an aerial and tune it with a variable inductance connected to the ground to the wave-length of the interfering station. This will balance out the unwanted signals. The loop may then be tuned to any desired wavelength.

I am confident that anyone constructing this aerial will be well repaid for the small amount of time and energy expended.

An Amplifier for Direct Current

(*Continued from page* 656)

F, *G*, and *P* are respectively the filaments, grids and plates of the tubes.

H =First stage.

K =Second stage. For simplicity only one tube is shown in each stage, although several connected in parallel were used.

B_1 and B_2 =8-volt batteries of sufficient capacity to supply the filaments connected to each battery. Each tube requires 2.3 amperes.

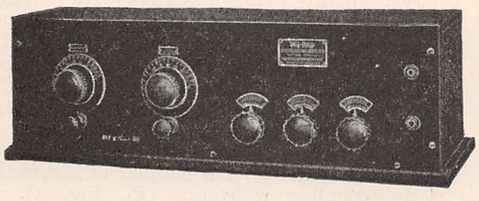
B_3 =Source of grid voltage of 22 to 110 volts, according to tubes used, capable of carrying about 40 milliamperes in a direction opposite to the voltage of this source.

B_4 =Source of plate voltage, 220 volts, capable of delivering 0.5 amperes.

Scene from the Opera "Faust"

The New Star in the Radio World

MOMENTOUS events in the arts and sciences are the result of rising above out-worn principles, independent of the tools of mediocrity. Beginning where others have been content to finish, a forward-looking group of radio engineers, comprising the Mu-Rad Laboratories, have designed and successfully constructed radio apparatus which is as advanced as the twenty-one-jewel watch is over the key-winder. Prices of this apparatus insure that great numbers will benefit from their achievements. Descriptive literature upon request.



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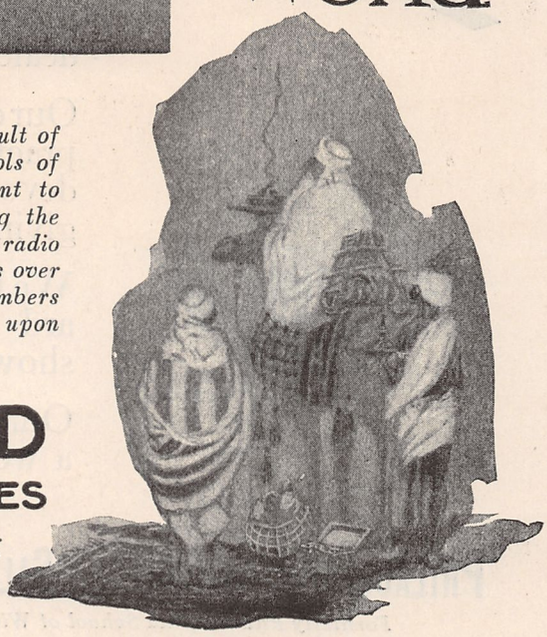
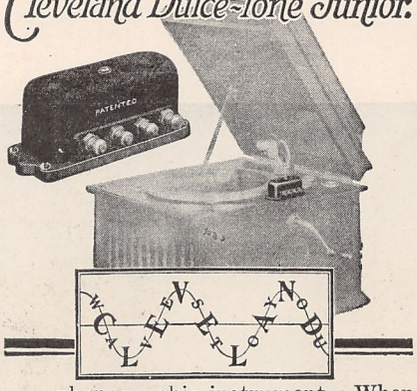


Radio Music Perfectly Reproduced Through Your Phonograph

Cleveland Dulce-Tone Junior



The Dulce-Tone Junior converts your phonograph into the finest of loud talkers without detracting in the least from its power to play phonograph records.

The radio music comes to you with cello-like sweetness, even more clearly than that reproduced from your records.

The Dulce-Tone Junior is adaptable to any phonographic instrument. When you consider that you are using the wonderful sound-box, tone-arm and even the needle which has been perfected only after years of experimenting, you can realize the QUALITY and SWEETNESS of the tone which is so faithfully reproduced through the Dulce-Tone Junior.

Any one can attach the Dulce-Tone Junior in a few minutes. To operate, simply swing the tone-arm, allowing the needle to rest on the small center element of the Dulce-Tone Junior. This ingenious instrument eliminates the necessity of numerous expensive head-phones when entertaining a roomful of people—is a true economy.

The Dulce-Tone Junior is the instrument of the century—an instrument that will improve any radio set. Put one on your phonograph today and realize the possibilities of radio music for quality of tone.

RETAIL PRICE ONLY.....$15.00 ($17.50 West of the Rockies)

If your dealer does not handle the Dulce-Tone Junior, fill out the coupon below, mail it with one dollar, and we will forward this wonder instrument to you C. O. D. at $14.00.

COUPON

THE CLEVELAND RADIO MFG. CO.
234 St. Clair Avenue N. E., Cleveland, Ohio

Enclosed find one dollar for which send me a Dulce-Tone Junior ($14.00 balance due C. O. D.) Send me your folder entitled "Waves to You Through Your Phonograph."

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Formerly Philadelphia School of Wireless Telegraphy

1533 PINE STREET PHILADELPHIA, PA.

B_5 = 40-volt battery to supply 200 milliamperes.

B_6 = (circuit 2 only) 12-volt battery to supply 20 milliamperes.

R_1 = Input resistance of 1000 ohms. The sensitivity of the amplifier can be controlled completely by varying this resistance. Increasing the resistance increases the current amplification and reducing the resistance decreases the amplification.

R_2 = Coupling resistance of 10,000 ohms to 55,000 ohms, according to number of tubes used. Both R_1 and R_2 should have a current capacity of 30 milliamperes.

R_3 = Resistance which must be variable by small steps from 150 to 300 ohms, such as a slide wire rheostat. Current carrying capacity 200 milliamperes.

TESTS

With the two circuits shown in Fig. 1 adjusted to give the highest amplification, measurements were made of the output current for an input voltage of 10 volts positive and negative which corresponds to an input current of 10 milliamperes through the input resistance of 1000 ohms. The current amplification, that is, the ratio of the output to the input current, is obtained by dividing the measured output current by the 10 milliampere input current.

RESULTS

The following table shows the amplification obtained with both circuits, using the tubes as indicated in the first three columns and also gives the values of coupling resistance and grid voltage (R_2 and B_3 respectively of Fig. 1) required for best operation in each case:

TABLE 1

Circuit 1

Number of Tubes			R_2 Ohms	B_3 Volts	Output Current with 10 M. A. input	Current Amplification
Total No.	1st Stage	2nd Stage				
2[1]	1	1	46 000	100	60	6
3[1]	1	2	46 000	100	100	10
4	1	3	56 000	88	120	12
5	2	3	14 000	110	130	13
6	2	4	14 000	110	160	16

TABLE 1

Circuit 2

Number of Tubes			R_2 Ohms	B_3 Volts	Output Current with 10 M. A. input	Current Amplification
Total No.	1st Stage	2nd Stage				
3[1]	1	2	12 000	45	70	7
4[1]	2	2	8 000	35	90	9
5	2	3	5 000	48	110	11
6	2	4	5 000	66	140	14

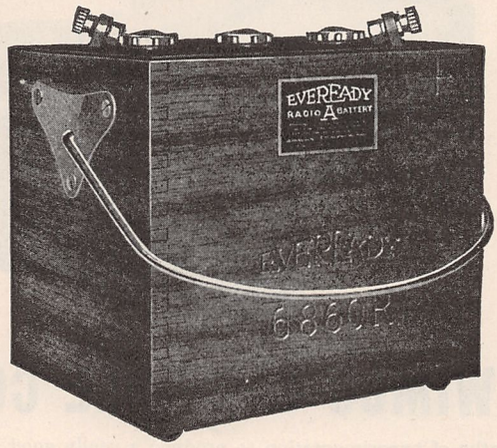
[1] Does not fulfill requirements

DISCUSSION

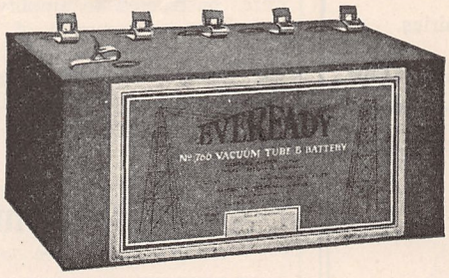
Table 1 shows that in order to fulfill the conditions that the input current of 10 to 20 milliamperes will be amplified to 110 to 200 milliamperes, the minimum number of tubes that can be used is four tubes in circuit 1 and five tubes in circuit 2. Circuit 1 should therefore be the more economical to use even though two separate filament batteries are required, because less tubes are required and the total current capacity of both batteries required to supply the filaments in circuit 1 is less than the capacity of the single battery required in circuit 2. Circuit 2 also requires an additional grid battery (B_6, Fig. 1) of 12 volts.

The difference in amplification of the two circuits is due to the manner of connecting the coupling resistance (R_2, Fig. 1). In circuit 1, the grid current of the second stage tubes acts as a regenerator, to increase the amplification for a given input current, while in circuit 2 the amplification is decreased by the grid current.

Eveready "A" Batteries
—hardwood box, mahogany finish
—convenient handle, nickel plated
—rubber feet protect the table
—insulated top prevents short circuits
—packed vent caps prevent spilling
No. 6860— 90 Amp. Hrs.—45 Lbs.—$18.00
No. 6880—110 Amp. Hrs.—52 Lbs.—$20.00



Eveready "B" Battery No. 766
Equipped with 5 positive voltage taps ranging from 16½ to 22½ volts. Fahnestock Spring Clip Binding Posts—an exclusive Eveready feature. Price $3.00



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Equipped with 6 positive voltage taps at 4½ volt intervals ranging from 18 to 43 volts. Fahnestock Spring Clip Binding Posts—an exclusive Eveready feature. Price $5.00

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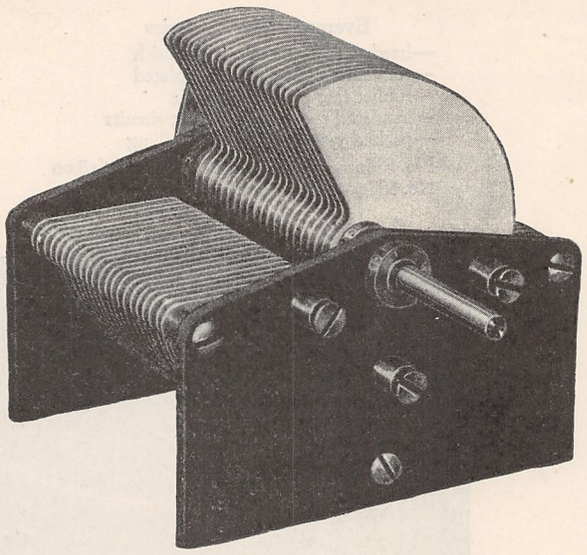


THE WIMCO VARIABLE CONDENSER

After months of experimentation to produce a really good Variable Condenser, we take pleasure in introducing to the trade The Wimco Variable Condenser, which will be furnished in 43, 23, and 3 plate type. Tests Conducted by the Washington Radio Laboratories show that The Wimco Variable condenser of the 43 plate type has a resistance, at maximum capacity, of but .018 ohms, and the capacity at zero on the scale is but 15 micro-microfarads. These values we believe, are lower than in any other condenser manufactured for general amateur use.

Deliveries on The WIMCO Variable Condenser will begin September 15th and we are now accepting Jobbers' and Dealers' orders.

We have a very attractive proposition for the Jobber, and solicit your inquiries.

THE WIRELESS MANUFACTURING CO., MANUFACTURERS DISTRIBUTORS **Canton, Ohio**

Stahl Insulated

SHORT PROOF

Variable Condenser

Impossible to short circuit.

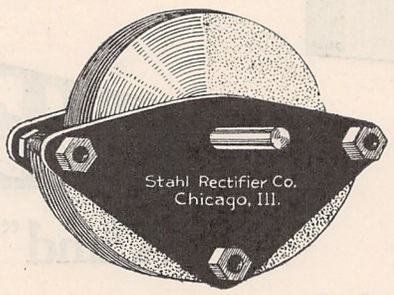
Every condenser given 1,000-volt breakdown test before leaving factory.

This is because we use non-conductor composition plates, with one surface of each plate electrically copper-plated.

Copper and non-conductor always face each other. Insulation is complete. Climate and weather conditions cannot affect it.

This enables us to use smaller plates, closer together, making the condenser more compact.

Furnished in all standard capacities with or without dial and knobs.



PRICES WITHOUT DIAL OR KNOB

11 Plates **$4.50**
23 Plates **$4.75**
45 Plates **$5.00**

Dealers, write for sample and discounts.

Manufacturers of Radio Sets are invited to arrange with us for the adoption of the Stahl Insulated Condenser as standard equipment.

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Variable Condensers, Variometers, Head Phones, Etc.

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ADJUSTMENTS

The necessary adjustments to put the amplifier in proper operating condition are:

(1) Filament Current: The filament current is adjusted by means of a series rheostat to 2.3 amperes per tube, or the filament voltage to 7.4 volts. With an 8-volt storage battery and low resistance leads no external resistance is necessary.

(2) Output Current: With no input current flowing, the resistance R_3 of Fig. 1, is adjusted until the output current is reduced to zero. The amplifier is now ready for operation.

If changes occur in the plate voltage supply or a tube is replaced, it may be necessary to readjust R_3 to reduce the output current to zero with zero input current.

GENERAL

The plate supply (B_4, of Fig. 1) may be of any voltage between 200 and 250 volts. A 220-volt D. C. light or power line may be used provided that the voltage does not vary more than about 10 volts.

With a plate supply of less than 200 volts the amplification decreases rapidly, while voltages in excess of 250 overheat the tubes and make their operation unsteady.

The above tests were all made using UV-202 Radiotron 5-watt power tubes. Other tubes suitable for current amplification are Western Electric type *E* tubes. With these tubes somewhat less amplification was obtained, and not as steady operation because of heating.

SUMMARY

Two resistance-coupled amplifier circuits were constructed to amplify both a direct and alternating current of 10 milliamperes to 110 to 200 milliamperes magnitude, and tests made to determine the amplification for best adjustments of the circuit constants.

(*Abstract from The Journal of the Optical Society of America*)

A Radio Romance

(*Continued from page 623*)

young Professor Baldwin, who had a wife to support now, and he was reduced to the necessity of gaining a livelihood as best he might in a community where few dared befriend him. His credit at the grocery store had mysteriously been cancelled, and he was compelled to accept whatever employment he could find that he might earn money to live. He dug post holes and he cleaned flues—but he did not change his mind about what he regarded as his right to freedom of speech.

A position as operator of a hydro-electric plant, for which he was well qualified, was offered him at Mountain Lake, 20 miles in the mountains. He took the job, but his tenure was short.

A similar place was open with the Progress Co., a small concern with a powerhouse in Mill Creek canyon, 50 miles away, in the mountains adjacent to Salt Lake City. Into this secluded canyon Baldwin took his family, and there he perfected and patented his receiver.

With money he saved from his salary he purchased the lot where his rambling plant stands, and put up the first diminutive unit of his factory.

From that time onward his progress was marked by the experiences usual to the making and marketing of patented devices in competition with long-established articles. His receiver was a practical one, and certainly was more sensitive than those in

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List Price { Type AB1, Type AB2, Type AB3 } $6.00 each

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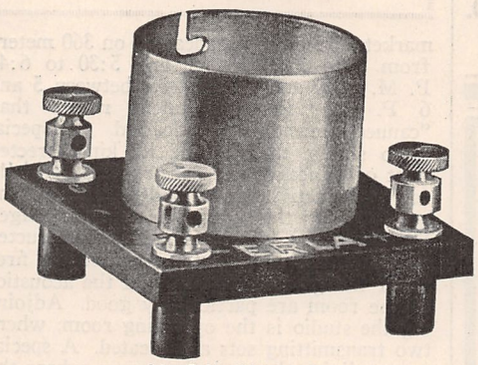
THE superior efficiency of the ERLA radio frequency transformer is winning recognition everywhere. Experts who have tested it are unanimous in declaring that it gives results far surpassing their best previous experience.

It is the first transformer successfully to overcome the high capacitance effects of domestic vacuum tubes. Likewise, the capacitance effect of the transformer itself has been reduced to a degree heretofore unattained, enabling its successful application to as many as three stages of amplification, with a uniform and high step-up ratio between each stage.

The addition of even one stage of ERLA radio frequency will work an amazing improvement. Range and tone volume are greatly increased; tone quality and definition much improved, with a minimum of interference, tube noises and other disturbances.

Even though you are now using other transformers, it will pay you to install the ERLA. Diagrams of circuits using one or more stages of ERLA radio frequency are available on request.



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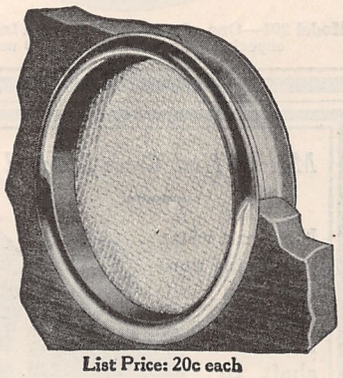
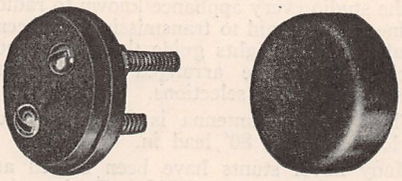
The strongest and most beautifully finished socket on the market. Heavily nickeled brass shell on polished Radion base. Insulated hard rubber feet. Special binding posts for quick wiring. Rugged contact springs will not arc under filament current of five-watt transmitting tubes. Fits any American four-prong tube. Greatly improves the appearance of any set.

BEZELS

Beautifully made of heavily nickeled brass, these screened bezels will add 100% to the neatness and attractiveness of any receiving set. Telescoping rim gives perfect fit of 1½" hole in any ⅛" to ¼" panel. Screen provides full view of tube filament, at the same time furnishing ample ventilation. No well made receiving set should be without this latest improvement.



List Price: 20c each



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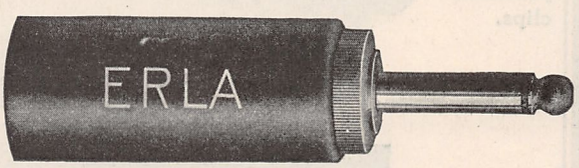
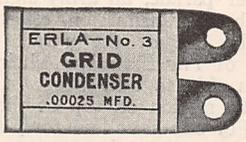
Built to ERLA quality standards. Hard fibre base; brass cap with durable hard rubber finish. Screws and nuts heavily nickeled. Pencil mark type; resistance varied as required. List Price: 50c each.





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The holes of this condenser are spaced to fit the lugs of the ERLA grid leak, making it quick and easy to mount and unmount. This is Type 3, .00025 mfd. capacity. List Price: 25c each.

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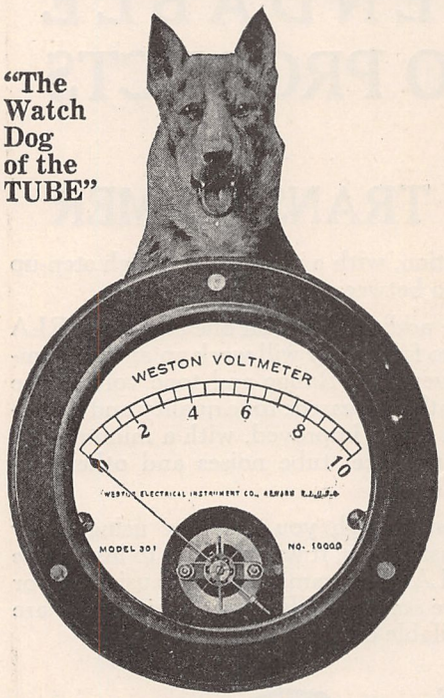

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Weston

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The length and quality of service received from a TUBE depends almost entirely upon your regulation of the filament voltage. To endeavor to judge this voltage by the degree of illumination of the filament is GUESSWORK and is certain to mean the loss of many tubes prematurely.

The Weston Filament Voltmeter indicates positively the voltage being used, making it possible to prevent many unnecessary burn-outs and to easily keep within the voltage limits that insure best results.

This voltmeter costs but little more than one tube. It pays for itself quickly in tubes saved. Make it part of your regular equipment at once.

Write to-day for Circular "J" describing this and other Weston Instruments composing the complete RADIO Group. If your dealer cannot supply your needs from stock we will gladly do so.

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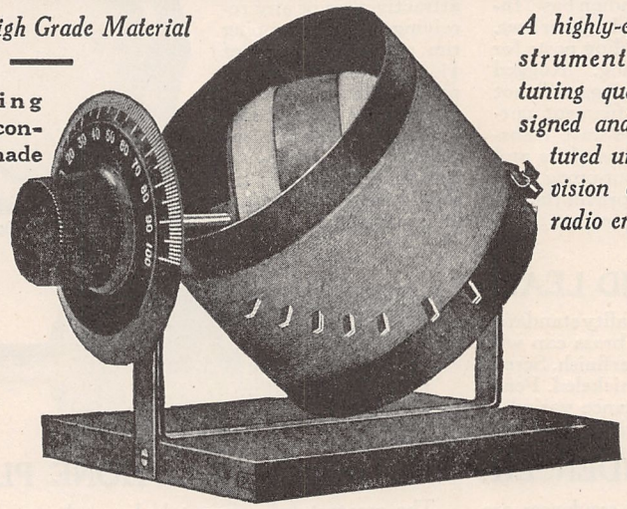
Branches in All Large Cities.

Made of High Grade Material

No moving contacts; connections made through hollow shaft to patented clips.



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general use by telephone companies. It may have been too sensitive for the average ear, or it may have been that its greater cost kept down the volume of its sales.

At any rate, until the advent of radio telephony, Baldwin's factory, with the addition of another small building from time to time, was adequate for the manufacture of all the receivers he could sell.

Then came the tremendous interest in radio, and with it came the avalanche of orders that since November has exceeded the capacity of his plant by the enormous total of 200,000 sets.

An idea of what it may mean when an inventor's dream comes true may be had when it is stated that the filling of these surplus orders has been contracted on the basis of a royalty, said to be two dollars on each set.

Meanwhile Baldwin will go on supervising his little factory, helping to get out its normal production of 150 sets each day.

Nathaniel Baldwin is a modest and unassuming man. With flannel shirt open at the neck he stands with his elbow on the drafting table in his little office, smiling in a dazed sort of way as he talks. One could wish he were not quite so modest; then he might have been persuaded to pose for an unconventional picture.

Broadcasting from San Francisco

(*Continued from page* 623)

market advice are broadcasted on 360 meters from 3 to 3:30 P. M. and 5:30 to 6:45 P. M. daily and on Sundays between 5 and 6 P. M. Personal talent rather than "canned" music is broadcasted. A special radio studio, the first of its kind, erected west of Chicago, and constructed especially for radio activity, was built on top of the building. In this house of magic is staged the concerts. The building is constructed of trantelate, an asbestos composition, fireproof though non-metallic and the acoustics of the room are particularly good. Adjoining the studio is the operating room, where two transmitting sets are located. A special room adjoins the operating room, where the batteries and motor generators are located. In the studio every appliance known to radio engineers as an aid to transmission has been installed. Pilot lights guide the artists and special effects are arranged for various classes of musical selections.

The "T" type antenna is 300′ high and 85′ long with an 80′ lead in.

Many novel stunts have been staged as radio experiments by KUO. During the great Shriner parade, an army signal corps vehicle with a transmission telephone set traversed the line of the parade and the radio editor of *The Examiner,* sitting in the vehicle, was able to talk direct to the operator of the station on top of the Hearst Building. For one hour and forty-five minutes a steady conversation was maintained by voice, in which the radio editor described the features of the parade as a news story, which was copied by stenographers in KUO's operating room. Likewise, the description of the parade with all its colorful effects, as spoken into the transmitter by the radio editor in the moving vehicle was audible to thousands of persons confined to their homes or in their offices, both in the city and in the country, who were unable to witness the great spectacle.

KUO is the official broadcasting station of the State Board of Health, State Board of Education and the San Francisco Bar Pilots. Each week the bulletins of interest to the general public from the Health De-

VACUUM TUBE RECEIVERS

Clapp-Eastham Type HR

Compact, efficient, and very sensitive. Range up to 1500 meters. In nicely finished mahogany cabinet. **$40**

2-Stage Amplifier to match. **$40**

45V VAR. UNIT "B" BATTERIES

With phosphor bronze jiffy connectors. Unusually big value at . . . **$3.60**

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15 inches long, with ebony asbestos base. Regular price of this switch $5. **$2**

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CRYSTAL DETECTOR RECEIVERS

Biggest value on the market. Has Variable Condenser, Vario Coupler, Tapped Primary, Buzzer Test, Cord Tipped Jacks, Bakelite Panel **$20**

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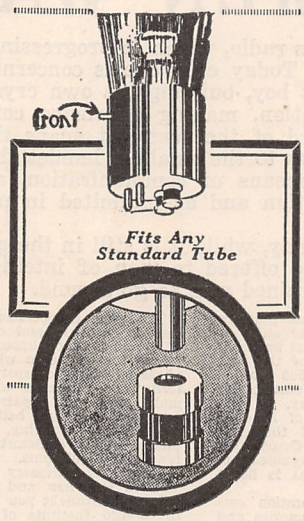
—make it possible to use Westinghouse Senior Tube in any Standard Socket **$1.50**

We carry a full line of Frost plugs and jacks



—*bulb insurance*

The moment you slip the Radeco Safety Fuse on the filament terminals of your vacuum tube, it's the same as if you covered that tube with a "burn out" insurance policy. It is impossible, even by accident, to "burn out" a bulb protected with the

RADECO SAFETY FUSE

(PAT. PENDING)

for VACUUM TUBES, METERS and other DELICATE INSTRUMENTS

Absolutely without affecting the efficiency of your set, this tiny protector, attached in a second to any standard bulb used in any standard socket, positively ends "burning out" and makes a tube last a lifetime.

Right now when tubes are not only expensive, but hard to get, *you cannot afford* to be without the Radeco Fuse. It means time, worry, money and trouble saved at trifling cost.

Come only in packages of four **4 for $1** *Order by mail or from your dealer*

We can make immediate delivery on sizes for the following tubes:

ELECTRON RELAY, A-P AMPLIFYING TUBE, DOUBLE FILAMENT AUDIOTRON, CUNNINGHAM C-300 AND C-301, RADIO CORP. UV-200, UV-201, UV-202 AND WESTERN ELECTRIC VT-1 AND VT-2.

When you order state WHAT tube fuses are for!

CAUTION: On many of the new tubes the solder on the contacts of the filament terminals is irregular. Before attaching the Radeco Safety Fuse file or sandpaper the solder off the SIDES of the terminal so that the fuse will slip on easily.

WE CARRY A COMPLETE STOCK OF PARTS AND SETS AT STANDARD PRICES.
ORDER FROM ANY STANDARD CATALOG

Reliable Goods at Right Prices

RADIO EQUIPMENT CO.

630 Washington Street, Boston, Mass.

New England's Oldest Exclusive Radio House

We Carry Only the Best Radio Goods

RADIO MEN WANTED

THE world's new industry is radio, which is progressing at a pace that has outstripped all records. Today everyone is concerned with wireless development, from the youngest boy, building his own crystal receiving set, to the largest electrical corporation, making expensive commercial apparatus. Radio is the world's safeguard of the seas. It spans the oceans, links the continents together, and brings to the smallest hamlet the intelligence of the world. Radio is the latest means of communication, a public, world-wide utility, romantic in its operation and as unlimited in possibilities as is the mind of man.

Get in this new industry today, while it is still in the growing period, while the greatest opportunities are offered to men of intelligence and initiative. Today there are not enough trained men to go around.

The one best way in which to touch this industry at its very center is through the course of study of the Radio Institute of America, a course that has been developed steadily with the industry during the past fifteen years, and has turned out over 6,500 trained men, 95 per cent. of whom have engaged successfully in this new branch of science and industry.

The graduates of the Radio Institute of America enjoy an exclusive advantage because of the close relation existing between it and the Radio Corporation of America, the world's largest wireless organization, operator of the Long Island Station, that is heard round the world.

Among the thousands of Radio Corporation employes, on ships and ashore, in offices, factories and laboratories, are many former students of the Radio Institute. Think what an advantage it gives you to be able to say: "I am a graduate of the Radio Institute of America."

Thousands of operators and executives all over the country, both in and out of the Radio Corporation, know what that phrase means. They know that it means that the man who says it, is trained in every phase of wireless—spark, arc, continuous wave, interrupted continuous wave transmitters, the design, maintenance and repair of transmitting and receiving equipment, storage batteries, motor generators, code sending and receiving, operation of the radio telephone, radio goniometry (direction finding), radio laws and regulations.

Everything necessary for making you a successful man in this new and tremendously important radio industry is taught you by the Home Study Course of the Radio Institute of America.

Radio, the newest development of the electrical industry, offers bigger things than the world has yet seen to those who will begin now to help work those things out to success.

The Radio Institute of America offers two courses of instruction, one in classrooms and laboratories, to those who can attend personally in New York, and the other by mail. The mail course is skillfully worked out and exactly parallels the personal course. Each student of the Home Study Division has personal attention given to his progress by the experts of the Institute. Code instruction at home is rendered possible by an ingenious automatic transmitting device, variable in speed, so that the beginner learns the code as fast as he is able, exactly as if an instructor sat at his side.

A three weeks' Post-Graduate Course in our New York City School is given, with no cost whatever, to any student in the Home Study Division desiring it.

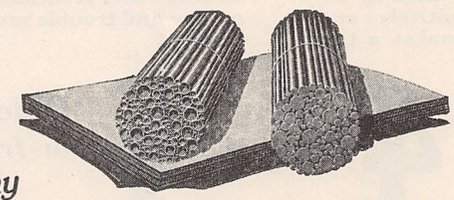
There is a booklet which we send free to you- "Radio, the New Field of Unlimited Opportunity." Send for it and learn more about the extraordinary th ngs that Radio offers to all men of energy and ambition.

HOME STUDY DIVISION

Radio Institute *of* America

(Formerly Marconi Institute)

324 Broadway, New York



Why

by sorting, dusting and cutting our own rags we make better fibre

You see if we didn't make sure that the rag stock were free of foreign substances, a piece of wire or perhaps a pin or nail might show up after you had spent some time in machining or finishing a piece of fibre. This would mean costly labor wasted.

We are always glad to guarantee Vul-Cot Fibre to be free of foreign substances. Incidentally, this care which we take in making the paper used in Vul-Cot Fibre increases its dielectric strength and lowers dielectric losses.

We'll be glad to send you a piece of Vul-Cot Fibre. And then if you want, we'll machine Vul-Cot Fibre to your specifications, or you may purchase it in sheets, rods and tubes.

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503 Equitable Building, Wilmington, Del.

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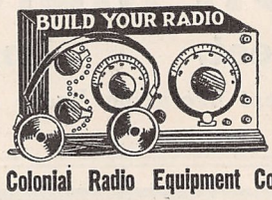
1663 JEROME AVENUE
Send for catalog of parts and equipment.
COMPLETE SETS $10.00 UP.



Save Money
Build Your Own At Home

Complete Standard Parts for Long Distance Radio Outfits. We do all machine work; you do the hand work; we tell you how. Immediate delivery. **Also complete Radio Sets** —all sizes at bargain prices. Write now for our big bargain catalog.

Colonial Radio Equipment Co., 4759 Calumet Avenue Dept. 11, Chicago, Ill.

partment of California, as well as from the State Board of Education, are transmitted by this station.

Broadcasting to the Ships at Sea

(*Continued from page* 628)

ficial for the men at sea, will do well to turn their attention to this new practical method of both diversion and education. One can even imagine the designation of certain ships as travelling Ocean broadcasting stations. And if directional and secret radio ever becomes a possibility, one can visualize the flagships of certain lines sending exclusive little chats to their own ships. But the sea is too big a brotherhood for that to become a possibility for other than purely commercial messages.

Practical observations show that broadcasted radiophone signals travel greater distances over sea than over land. Operators on the Transatlantic routes, who occasionally go down to the short-wave schedules, report hearing Newark clearly at distances of 1,700 miles and over, to the eastward. He has several times been picked up by vessels on the west coast of South America, or the coast of Peru. Vessels in the Gulf and West Indian waters hear him occasionally. An operator of our acquaintance coming aboard his ship in Tampico with a cargo of the product of Mexican distilleries in his system, happened to pick up the receivers and, hearing a lecturer in some northern city saying, "You must try it again and yet again" promptly went ashore and took the good man's advice.

With radiophone broadcasting at sea for purposes of entertainment will come radiophone conversations between ships for commercial and other purposes. It will be extremely interesting to watch the evolution of the use of radiophone for and by the ships at sea.

Anacostia Naval Air Station

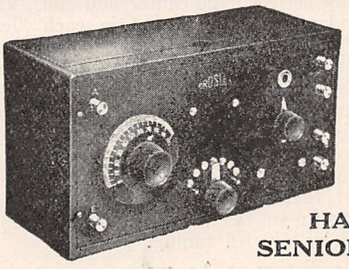
(*Continued from page* 622)

the band from the Marine Corps of the Navy Department introduced its concerts, on May 31 of this year, in excess of 2,000 voluntary letters have drifted into Washington complimentary to the character of its musical renditions. These communications have originated in 16 States, from Maine to Florida, with scattering testimonials from Ontario and Quebec, in Canada. The weekly program, invariably given on Wednesday evening, begins at 8:30 and continues for one hour. Fittingly, its renditions conclude with "The Star Spangled Banner." Thus the national anthem is broadcasted through space for a radius of hundreds of miles of Washington, the melodious strains drifting into the isolated farm home as well as that of the city-dweller.

Structurally, what manner of radio station is 'NOF'? This question, in perhaps different language, has been pondered in the minds of thousands of radio amateurs who have so frequently tuned their receiving sets to 412 meters. Therefore, a brief description of this 100 per cent. radio laboratory is not amiss. Its multiple-tuned antenna is of outstanding note, admitting of a variation in wave-length from 190 to 3,000 meters.

RADIO APPARATUS CROSLEY RADIO APPARATUS

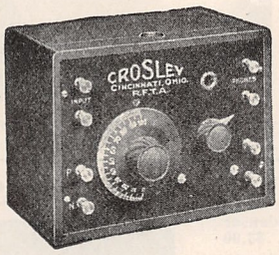
Better—Cost Less



EFFICIENT, satisfactory and economical, Crosley Radio Units have become well and favorably known to the trade.
Several of the Crosley early units, greatly refined in finish and detail, are illustrated here, together with several new models which have recently been perfected.
Crosley prices are remarkably low. These prices are made possible by quantity production and up-to-date methods employed in our factories.
Everywhere Crosley "Better—Cost Less" Radio Units are meeting with success.

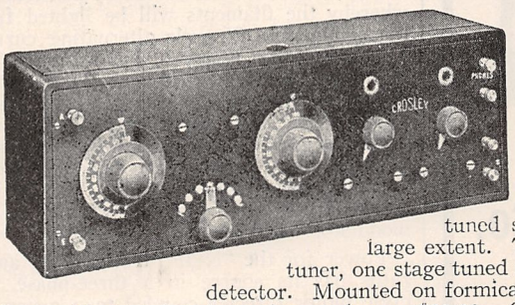
HARKO SENIOR NO. V

This instrument is a combination tuner and Audion detector, recommended for receiving broadcasting stations up to fifty miles. Under favorable conditions, ships and stations on the Atlantic Coast are easily copied in Cincinnati. Minnesota hears Newark, Denver hears Schenectady and other distant points are brought in except under adverse conditions.
Formica panel, Adam brown mahogany finished cabinet, price as shown without tubes, batteries or phones, $20.00. Crosley Harko Senior No. V is equivalent to Crosley Crystal Receiver No. 1 and Crosley Audion Detector Unit.



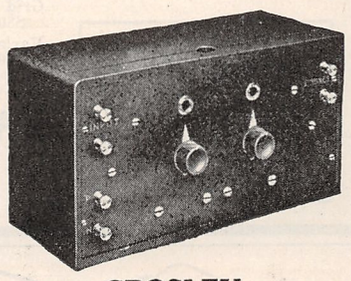
CROSLEY RADIO FREQUENCY TUNED AMPLIFIER (R. F. T. A.)

This unit can be used in connection with the Crosley Crystal Receiver No. 1 and Crosley Audion Detector Unit or with the Crosley Harko Senior No. V. It can also be used with practically any other type of Audion detector outfit. The tuning feature means selectivity, elimination of static and great increase in volume of signals. In combination with the above-mentioned units, the Crosley R. F. T. A. adds at least six times the volume and range. Price without tube or battery, $15.00.



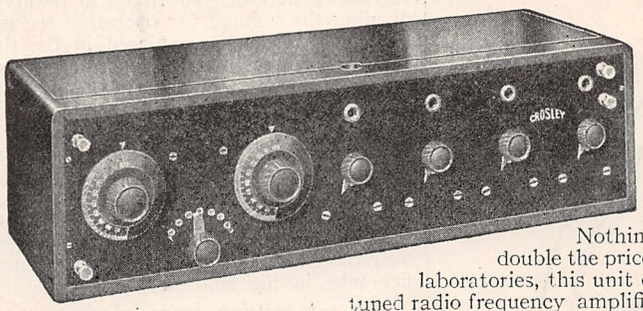
CROSLEY RECEIVER No. VI

This Unit has approximately six times the range and volume of the Harko Senior. With it, distant broadcasting stations are brought in loud and clear-tuned sharply. It also eliminates static to a large extent. The Crosley Receiver No. VI consists of tuner, one stage tuned radio frequency amplification and audion detector. Mounted on formica panel, Adam brown mahogany finished cabinet without tubes, batteries or phones, $30.00. Crosley Receiver No. VI is equivalent to the Crosley Crystal Receiver, Crosley Audion Detector Unit and Radio Frequency Tuned Amplifier or Crosley Harko Senior No. V and Crosley Radio Frequency Tuned Amplifier.



CROSLEY TWO-STAGE AUDIO FREQUENCY AMPLIFIER

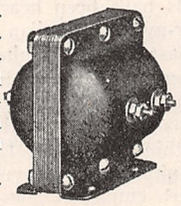
With this unit, two stages of audio frequency amplification can be added to any type of radio apparatus. Can be used in conjunction with the Crosley Crystal Receiver No. 1 and Crosley Audion Detector Unit, Crosley Harko Senior No. V, Crosley R. F. T. A. or Crosley Receiver No. VI.
This unit increases the volume about one hundred times.
Designed to match up uniformly with the above-mentioned units, without tubes, batteries or phones, $25.00.



CROSLEY RECEIVER NO. X

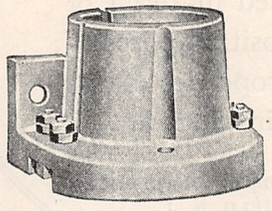
In placing this receiver upon the market, we are offering you a unit whose range, volume and selectivity are remarkable. Nothing can be compared with it at double the price. Developed in the Crosley laboratories, this unit combines tuner, one stage of tuned radio frequency amplification, audion detector and two stages of audio frequency amplification. As shown, without tubes, batteries or phones, solid mahogany cabinet, $55.00. Crosley Receiver No. X is equivalent to Crosley Receiver No. VI and Crosley Two-Stage Audio Frequency Amplifier.

CROSLEY SHELTRAN



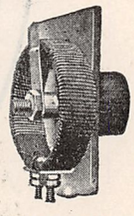
Incorporated in the design of the Crosley Sheltran, are all the characteristics so essential and necessary to obtain maximum amplification from the modern vacuum tubes used in radio work. These tubes, with their high amplification constant, operate most effectively at large fluctuations of the grid potential. The Crosley Sheltran is designed to accomplish these results and tests have shown that the design is correct to insure maximum efficiency. Completely shielded—9 to 1 ratio. "Better—Cost Less," $4.00.

CROSLEY V. T. SOCKET



This socket has been pronounced by many radio engineers the best socket on the market. Ever since its announcement, its success has been phenomenal. Although the success has been largely due to the price, its real popularity is based on its high quality, efficiency, service and practical unbreakability. Patents pending. Beware of imitators.
Made of porcelain for base or panel mounting, $ .50.

CROSLEY RHEOSTAT



This rheostat permits exceptionally accurate and delicate variations of the filament current. With it, the best possible results are received from expensive vacuum tubes.
Unique construction allows the Crosley Rheostat to be mounted on a panel of any thickness up to and including ⅜ inch. A special grade of non-corrosive wire forms the resistance and results in highly efficient service.
Furnished complete with newly designed tapering knob, pointer, etc.—"Better—Cost Less," $ .60.

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Dealers and Jobbers Who Handle Crosley Apparatus, Handle the Best

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RADIO SERVICE PRODUCTS

The Acknowledged Standard of the Radio Amateur

The

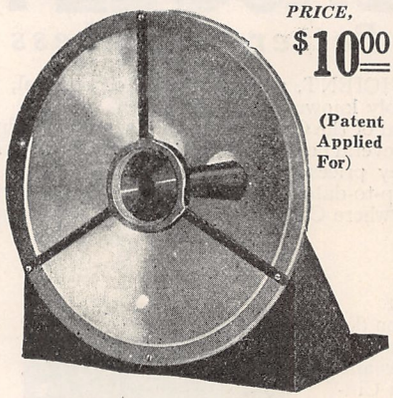
AMPLITRON

(A Real Loud Speaker)

The Amplitron is a product of the Radio Service Laboratory and has been designed and constructed especially for radio work. This instrument fills the need for a moderate priced loud speaker. It reproduces radio phone speech and music without distortion—equally good for code. No exciting batteries or adjustments necessary. Uses a Baldwin Type "C" single phone.

Price *(as illustrated)*.....**$10.00**

Price *WITH BALDWIN PHONE AND CORD*.....**$16.50**



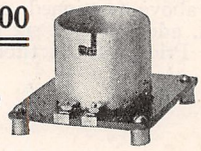
PRICE, **$10.00**

(Patent Applied For)

OTHER RADIO SERVICE PRODUCTS

Single VT Socket

$1.00



Type S10

We carry numerous other types of interest to Radio dealers and wireless men. Radio Service Products are for sale by all reliable dealers.

Triple VT Sockets Type S4 .....$3.00

23 Plate Variable Condenser without dial.....$3.00

43 Plate Variable Condenser without dial.....$3.75

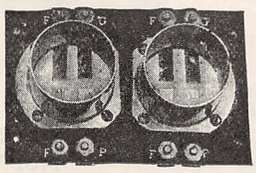
Grid Condensers .0005 mf. Type S15.....35c

Phone Condensers .002 mf. Type S16.....35c

Grid Leak Condensers Type S30 .....50c

Variable Grid Leak Type S40, ½ to 3 megohms..75c

Double VT Socket



Type S3 **$2.00**

RADIO SERVICE & MFG. CO.

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There are all kinds of insulations; nearly all vary as to quality. There is one sure way of obtaining the best.

Specify

Condensite

A standardized material of known composition, possessing all the properties essential to radio insulation.

Condensite Company of America

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C-B RECEIVING SETS

1-2-3 Steps

RADIO FREQUENCY

Loud Speaker on 6 in. Loop Fits Phonograph Cabinet

Cooper-Byron Radio Electric Corp.

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VULCANIZED FIBRE

Be sure and specify

"WILMINGTON FIBRE"

Sheets, Rods, Tubes, Washers, Etc., Specialties

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Branch Offices "Everywhere"

The antenna is comprised of half a dozen wires, spaced 3′ apart and 235′ long, supported by two 100-foot guyed masts. The "down leads" are five in number, contrary to the conventional antenna with only one. These are equally spaced, one at each end, another in the center, and one on each side half-way between the center and end. Variable inductances are found in each "lead" at the end reaching the ground, these being protected from unfavorable weather conditions by inconspicuous wooden boxes surrounding them on the earth. Each "down lead" is "grounded" through its inductance to a copper-screen interred in the soil to a depth of five feet. The electric current in each of these "down leads" is of uniform capacity in so far as possible, a condition insured by careful tuning.

The radiation at Anacostia, comparatively of a high value, is obtained on low-power consumption—not exceeding one and one-half kilowatts. The multiple-tuned antenna vouchsafes this virtue. The transmitting unit employs the master-oscillator power-amplifier system. The latter involves the use of three 250-watt pliotrons, actuated by 1,500 to 1,600 volts on the plates. The electrict strength for the filaments, at present, has its source in 24-volt batteries, but a transformer is in the course of construction whereby the filaments will be lighted from the commercial 25-cycle alternating current supply in the research laboratory. The master-oscillator is a 50-watt filament tube and the master-modulator is of similar caliber. The oscillator is linked to the grids of the power-amplifier tubes with reasonable loop-coupling, a provision which prevents the amplifier tubes themselves oscillating. A 5-watt speech amplifier precedes the modulator tube.

Power for the "NOF" transmitting apparatus has its source in a three-phase, 60-cycle motor directly coupled to a generator whose complete load ranges from 700 to 1,600 volts. A half-way tap is accessible on the generator, affording a means of dividing the voltage for operating the master outfit. Filters are placed in the three lines extending from the generator so as to minimize commutator and slot ripples. The transmitter at Anacostia is subject to remote control from the building of the Navy Department in Potomac Park. When a remote telephone station is thus employed, the operation of the transmitting outfit involves the use of an additional five-watt tube amplifier between the incoming speech over the telephone line and the speech amplifier tube in the laboratory.

The transmitting range of Anacostia at night has been variously estimated to be from 300 to 1,000 miles radius of Washington. Speaking in terms of its maximum radiating distance, its radio-telegraph signals have been heard and acknowledged in far-away Hawaiian Islands, on the Pacific Coast of the United States, and off the mouth of Orinoco River in South America. The daytime range of its radio-telephone broadcasting would doubtless be limited within a radius of 150 miles of the National Capital, in the event that daylight hours were employed for this form of transmission. Verily, "NOF" is a government radio station whose programs of performance are novel in character and surprisingly efficient.

Correction Notice

We regret that, through an oversight, in the August issue of RADIO NEWS, the conclusion of the article entitled "A. C. Rectification for C. W.," which commenced on page 234 and was partly concluded on page 338, was not continued on the proper page. The continuation from page 338 will be found on page 330.

The Willard Radio "B" Battery with glass jars and Threaded Rubber Insulation is the most practical insurance against leakage *noises* and leakage *losses*.

Why Gamble on "B" Batteries?

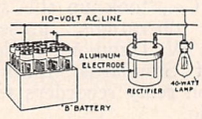
You're careful in soldering connections. You spend good money for additional stages of amplification. You give special attention to insulation of aerial and lead-in.

If you've gone that far, you simply can't afford to take a chance on having a leaky "B" Battery spoil it all with a bombardment of leakage noises. *You can't afford anything less than a leak-proof Willard "B" Battery.*

Every cell of a Willard "B" Battery is an individual glass jar. Jars are well-spaced to prevent leakage from cell to cell. Threaded Rubber Insulation protects the plates and thus guards against inside leaks.

Because of the leakproof feature Willard "B" Batteries are unusually quiet and hold their charge for long periods.

Ask your radio dealer or the nearest Willard Service Station to show you the Willard 6-volt Radio "A" Battery and the Willard 24-volt Radio "B" Battery.

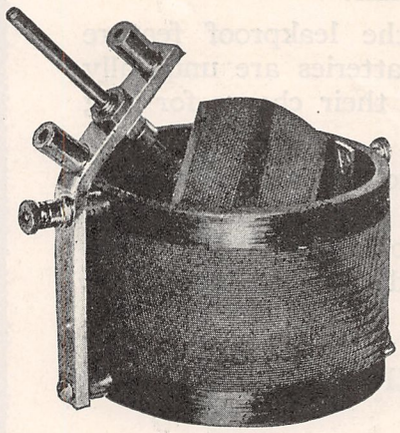


This rectifier will keep your "B" Battery charged at a cost of a few cents a month.

WILLARD STORAGE BATTERY COMPANY
Cleveland, O.

Made in Canada by the
Willard Storage Battery Company of Canada, Limited, Toronto, Ontario

Willard THREADED RUBBER BATTERY



Wilmaco 180° Variocoupler

All parts nickel plated; fibre tubing; 175 to 700 meters wave length; green silk wire on primary and secondary. This is the best value on the market.

Price $5.25

We also make a complete line of radio equipment, including the famous Wilmaco Receivers at $40.00.

If your dealer can't supply you, write to us direct.

DEALERS: Write us for an excellent proposition.

WILSON, McGUIRE CO., INC.
1004 TREAT AVE., SAN FRANCISCO, CAL.

MANUFACTURERS AND JOBBERS

We have a new device for use on every tube set. Descriptive bulletins will be ready for distribution by the time this issue reaches you. Write for particulars.

Wireless Appliances Company
Old Colony Bldg., Chicago

WANTED Reliable JOBBERS for our bakelike variocouplers. Double green silk covered wire wound securely upon a moulded stator and rotor tapped so as to obtain a one-turn variation over its entire range. No shellac used!

$5.00 Attractive discounts to dealers and jobbers

Ridgewood Radio Shop
1603 Myrtle Ave. Ridgewood, L. I.

International Radio Congress at Chicago

(*Continued from page* 631)

"Hence, the problem of radio transmission," Dr. Steinmetz continued, "is that of directing the radio waves so closely that a large part of their power remains together so as to be picked up by the receiving station. Much successful work has been done in directing radio waves, and, for instance, our trans-Atlantic stations send out most of their power eastward. However, even as directed, the power scatters over the coasts of Europe from Norway to Spain, so that it is impossible to pick up any appreciable part of it.

"Suppose we have a very large station sending out electro-magnetic waves not of hundreds, but of hundred thousands of millions of kilowatts, and suppose we could find a wave-length where the absorption in the passage of the wave through space is sufficiently small so as to be negligible compared with the amount of power. Suppose we now erect a second station, tuned for the same wave-length as the sending station. It would resonate with the standing electro-magnetic wave issuing from the sending station, thereby stopping its passage by absorbing its energy. It would, as we may say, punch a hole in the standing wave sheet coming from the sending station. Power would then flow into this hole, the sending station would begin to send out additional power to maintain the wave sheet, and this power would be received by the receiving station. This would give a real radio power transmission. Any receiving station of suitable design would then be able to pick up power from the universal power supply carried by the standing wave sheet covering the earth. It would have to be economically permissible, and feasible. It would have to be an international development. Even if such radio transmission by a stationary electro-magnetic wave sheet were possible, its realization at best is rather distant and the present outlook for radio power transmission somewhat remote."

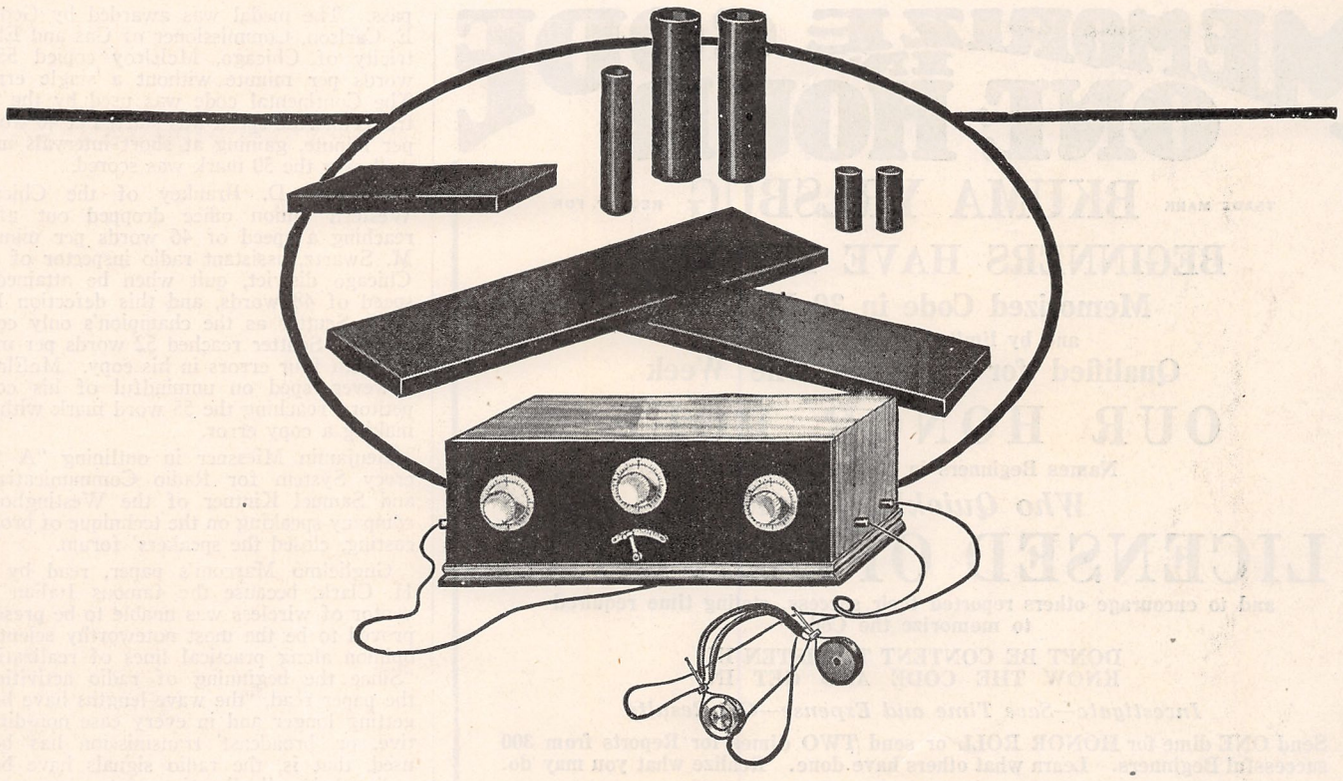
A number of engineering clubs gave Dr. Steinmetz a dinner recently at the Hotel Morrison, the guests numbering fully 200 radio and electrical representatives from the middle western territory.

R. H. G. Matthews of the American Radio Relay League read a paper on "Amateur Radio." Lieutenant Colonel Louis R. Krumm, superintendent of radio operations of the Westinghouse Electric and Manufacturing Co., took up the subject of broadcasting operations, present and future. Francis W. Dunmore, radio laboratory, Bureau of Standards, Washington, gave his views on relay recorders for remote control by radio.

John Mills, one of America's leading electrical engineers and the author of several technical books of merit, dealing with the development of the present system of radio and telephonic communication, entertained the Congress with his widely known talk, "The Human Voice and Its Electrical Transmission." Mr. Mills was educated in Chicago, graduating in 1901 from the University of Chicago, having the distinction of being the first person whose voice was carried through the ether across land and sea from Washington to Honolulu when radio reached an advanced stage in 1915. He is at present with the Western Electric Company at New York City. Other members of the Western Electric research departments present at the Congress were R. A. Heising, and H. W Nichols.

T. R. McElroy of Boston, an employee of the Western Union Telegraph Company, won the Carlson diamond medal for speed and accuracy in a radio receiving contest held as one of the principal practical features of the Congress.

Surrounding McElroy was a field of radio wizards from all points of the com-



Why *Formica* Is the Best Radio Insulation

FORMICA practically absorbs no moisture. Hence it never warps or develops current leaks.

Fumes, steam, heat and most chemicals do not affect it.

It is not brittle and will not crack.

The finish is a handsome brown or black, perfectly uniform and glossy unless it is sanded. It makes a panel of splendid appearance and one that never loses its good looks.

Formica manufacturing methods make Formica what it is—the most popular and widely used radio insulation.

The cotton rag Filrous base which is the base material of the radio grade has been developed scientifically for use in Formica only. This is thoroughly soaked in Redmanol resins, cut in sheets and fused or vulcanized under great heat and pressure into a solid piece of Formica.

The resin is handled with the greatest accuracy so it will be always perfectly uniform and aged just right when it is used. Temperature control is most exact.

Don't believe that all radio insulation is alike. Only Formica is like Formica. Insist on it.

DEALERS: Formica probably has the "call" in your territory as it has nearly everywhere. We have recently doubled our capacity and can now deliver your orders promptly.

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Memorized Code in 30 Minutes

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Qualified for Exam in One Week

OUR HONOR ROLL

Names Beginners in 10 Radio Districts

Who Quickly Became

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and to encourage others reported their success, stating time required to memorize the Code

DON'T BE CONTENT TO LISTEN IN
KNOW THE CODE AND GET IN

Investigate—Save Time and Expense—Get Results

Send ONE dime for HONOR ROLL or send TWO dimes for Reports from 300 successful Beginners. Learn what others have done. Realize what you may do.

ATTENTIVE BEGINNERS WHO USE

DODGE ONE DOLLAR RADIO SHORT CUT

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C. K. DODGE BOX 200 MAMARONECK, N. Y.

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Includes All Necessary Panel Mountings for a Complete Crystal Receiver

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18 Switch Points with Nut
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All Parts Polished and Nickel-Plated with Our Unequaled Finish.

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pass. The medal was awarded by George E. Carlson, Commissioner of Gas and Electricity of Chicago, McElroy copied 55.01 words per minute without a single error. The Continental code was used by the entrants and the speed was started at 40 words per minute, gaining at short intervals until well over the 50 mark was scored.

Benedict D. Brankey of the Chicago Western Union office dropped out after reaching a speed of 46 words per minute. M. Swartz, assistant radio inspector of the Chicago district, quit when he attained a speed of 48 words, and this defection left B. J. Seutter as the champion's only competitor. Seutter reached 52 words per minute with four errors in his copy. McElroy, however, sped on unmindful of his competitors, reaching the 55 word mark without making a copy error.

Benjamin Miessner in outlining "A Secrecy System for Radio Communication," and Samuel Kintner of the Westinghouse company speaking on the technique of broadcasting, closed the speakers' forum.

Guglielmo Marconi's paper, read by G. H. Clark, because the famous Italian inventor of wireless was unable to be present, proved to be the most noteworthy scientific opinion along practical lines of realization. "Since the beginning of radio activities," the paper read, "the wave-lengths have been getting longer and in every case non-directive, or 'broadcast' transmission has been used, that is, the radio signals have been radiated in all directions into space, that one particular receiving station out of the millions of possible receivers may gather in the signal. Only in the last year when broadcasting of general information has become popular, have the 'radial' features of modern radio communication really been utilized at all.

"One of the reasons that short waves have been neglected so long is that there is far greater 'fading' experienced with their use. That is, signals might be extremely strong at one moment and the next moment might die to inaudibility, a characteristic which is by no means so marked when the wave-length is made greater.

"It has long been appreciated that, apart from fading, short waves were much more efficient than long, as, for instance, the recent achievement of the American amateurs in reaching England with only a few hundred watts on a short wave-length, whereas commercial stations on wave-lengths hundreds of times longer must use powers of several hundred kilowatts.

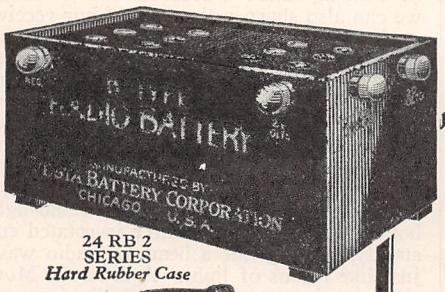
"The point to be noted here, however, is that the amateurs happened to 'get through' once, out of thousands of times of failure, and succeeded that once because 'absorption' or 'fading' happened to be noticeably absent for a brief period, whereas the commercial stations get through practically all the time.

"Now, directional transmission offers a further possibility for getting messages through with low power because all the power that is available is concentrated over a few degrees of arc rather than sent, uselessly, in every direction in order to be utilized in one only. Directional transmission means reflection of the created energy by local reflectors so as to catch and send back energy that otherwise would go in the wrong direction, and since reflectors must have comparable dimensions to their reflected waves, it is not today practicable to reflect wave-lengths of thousands of meters in length, but with waves of 50 meters it is another question. Directional transmission is, therefore, possible on short wave-lengths.

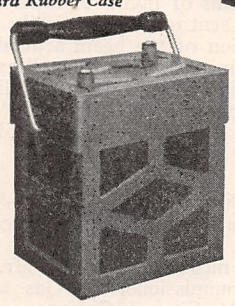
"Direction reception, or picking up a message that is coming from one given direction and not picking up others from sources of different locations, has been with us for some time, so that we can directly make use of this for the new development of radio.

"We have, therefore, the well known fact

Adv. No. 47



24 RB 2
SERIES
Hard Rubber Case



R 6 EA SERIES
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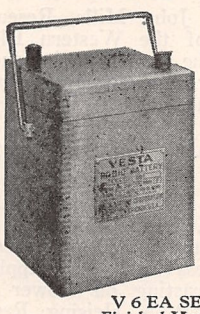
6 EA SERIES
Black Wood Case



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PRICES

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6 EA 5	60	$17.50
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6 EA 9	100	23.00
V 6 EA 7	80	21.50
R 6 EA 9	100	28.00

Vesta six-volt Radio Batteries are made in three styles and three sizes. The ampere draw of a vacuum tube is approximately one ampere—24 RB 2, "B" type, $9.00.

Any Radio Set Is a Better Set With Vesta Batteries

The name Vesta on your radio battery is absolute assurance of long, dependable service, free from the vexations of having the current output drop at the critical moment.

No need to run back and forth constantly to the service station for recharging with Vesta "A" storage batteries. The extra heavy plates retain their charge over long periods.

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Vesta Radio Batteries are made in the styles illustrated. Two or four years' service may be expected from these batteries if kept watered and recharged when gravity falls below 1200°.

Vesta Service Stations catering to the automobile trade and radio dealers are supplying these batteries. Consult your phone book or write us if you are unable to find a local Vesta dealer.

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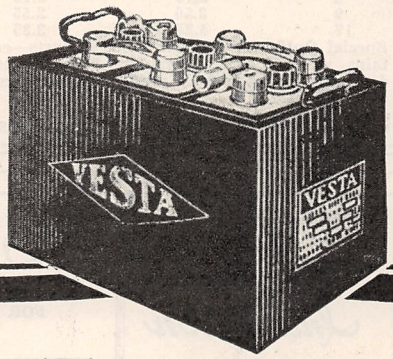

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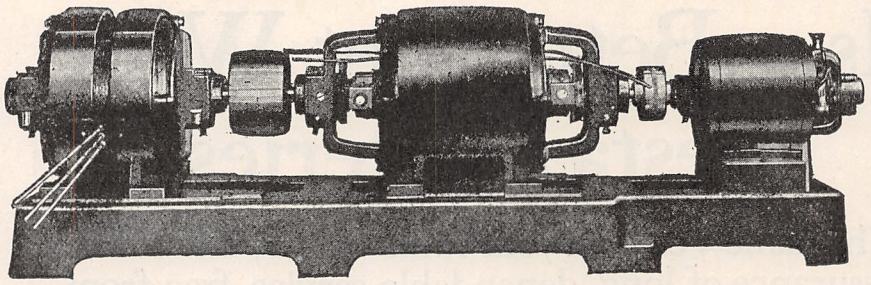

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Used by Leading Educational Institutions, U. S. Army and Navy Academies, Research Laboratories, Newspapers, Dept. Stores and Broadcasting Stations

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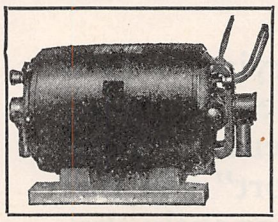

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designed to suit the capacity requirements of every set; mechanically and radio-electrically correct.

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FOR FUN AND FOR SATISFACTION

A new idea of proven popularity both with amateurs, experts and schools. Construct a condenser which tunes instantly and accurately; which cuts out static, interferences, etc., by a twist of the wrist, and which brings in the signals as clear as a bell. And save money.
Plates cannot get out of true. Hair-breadth accuracy maintained throughout. High oscillative power factor, minimum interference guaranteed.
Full directions and special tools accompany every outfit.
And should you wish to increase the capacity of your set at any time, you may obtain just the parts you need from your dealer or directly from us. A sound, economical principle to build on.

SIZES AND PRICES

Write Now for Special Christmas Order Proposition—Very Profitable

No. of Plates	Price, Assembled	Price, Ready to Build	No. of Plates	Price, Assembled	Price, Ready to Build
3	$2.50	$1.90	23	$5.25	$3.80
5	2.75	2.10	35	6.00	5.15
9	3.50	2.55	43	6.50	5.60
17	4.25	3.35	67	10.00	8.40

Special Outfit for Radio Service Experts—contains parts for five complete 23 plate condensers. Makes a fine, profitable spare parts box for store.

RETAILERS—You will be interested in our novel Xmas selling plan, which assures fast turnover, liberal profits and repeat customers. Original and attractive window display backs up our national advertising and attracts customers to your store.

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that short waves are ideal from the standpoint of energy; we have the possibility of sending these waves in one direction; we can also sharpen the eyes of our receiver so it is blind in all but one direction and especially keen in that one. There still remains the problem of intermediate absorption. Distances of 50 miles have been reached already on this short-wave directive work, using radio-telephony, and experiments on far greater powers are now in progress.

"Further application is with radio-lighthouses. A radio transmitter is rotated constantly, sending out a beam of radio waves just like beams of light. A different Morse character is sent out automatically for every major position of the beam around a circle, and by this means a ship can tell exactly her position with respect to the lighthouse. This is being tried in England."

Below is given the program of the exposition:

SUNDAY, AUGUST 6th, 10 A.M.

Radio Marathon. Diamond medal speed contest for radio operators.

Diamond medal donated by Mr. Geo. E. Carlson, Commissioner of Gas and Electricity of the City of Chicago.

The test was conducted by Mr. Lawrence R. Schmitt, former U. S. Radio Inspector, 9th district.

MONDAY, AUGUST 7th, 10 A.M.

A.M.

10:00 Opening remarks by the President of the Radio Congress, Major J. O. Mauborgne, Signal Officer of the 6th Army Corps Area.

10:05 Mr. Benj. Miessner on "A Secrecy System for Radio Communication."

10:50 Mr. Samuel M. Kintner, General Radio Engineer, Research Dept. of the Westinghouse Electric & Mfg. Co. on "The Technique of Broadcasting."

11:35 Mr. John Mills, Research Engineer of the Western Electric Co., on "The Human Voice and Its Electrical Transmission," illustrated by motion pictures.

MONDAY, AUGUST 7th, 2 P.M.

P.M.

2:00 Dr. Louis Cohen, Consulting Engineer, Signal Corps, U. S. Army, Washington, D. C., on "Wired Wireless and Its Application to Broadcasting on Power Lines."

2:45 Mr. R. A. Heising, Research Engineer of the Western Electric Co., on "How Speech Is Carried."

3:30 Dr. J. H. Dellinger, Physicist in Charge of Radio Laboratory of the Bureau of Standards, Washington, D. C., on a subject to be announced later.

4:15 Senatore Guglielmo Marconi on "Radio Telegraphy." Discussion.

TUESDAY, AUGUST 8th, 10 A.M.

A.M.

10:00 Mr. A. A. Hebert, Treasurer of the American Radio Relay League, on "Amateur Radio."

10:45 Lt. Col. Louis R. Krumm, Superintendent of Radio Operations of the Westinghouse Electric & Mfg. Co., on "Broadcasting Operations, Present and Future."

11:30 Dr. H. W. Nichols, Research Engineer of the Western Electric Co., on "Radio Communication."

TUESDAY, AUGUST 8th, 2 P.M.

P.M.

2:00 Mr. Francis W. Dunmore, Radio Laboratory, Bureau of Standards, Washington, D. C., on "A Relay Recorder for Remote Control by Radio."

When Marconi heard the AERIOLA GRAND

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"IT comes closest to the dream I had when I first caught the vision of radio's vast possibilities. It brings the world of music, news and education into the home, fresh from the human voice. It solves the problem of loneliness and isolation.

"The Aeriola Grand is at present the supreme achievement in designing and constructing receiving sets for the home—a product of the research systematically conducted by scientists in the laboratories that constitute part of the R C A organization."

G Marconi

Look for this trademark at your dealer

The importance of the Symbol R C A

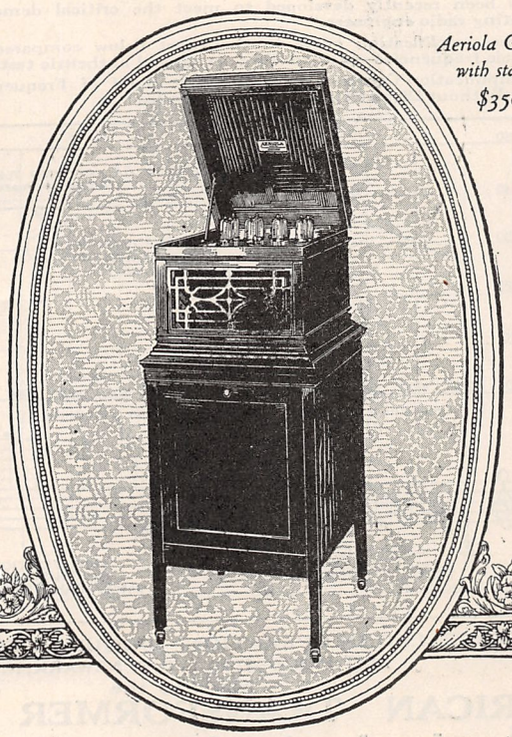
CRUDE radio apparatus of a kind can be made even by embryonic organizations. But the vitally important inventions that have made radio the possession of every man, woman and child are those protected by patents owned by the Radio Corporation of America and developed as the result of costly research conducted in the engineering laboratories of the Radio Corporation of America.

The name-plate of a Radio Set is all-important in the purchase of radio apparatus. If it bears the letters "R C A" the public and the dealer are assured that at the time of its introduction it is the highest expression of the advancing art of radio.

In tone quality, in simplicity of manipulation the Aeriola Grand is unrivalled. A child can snap the switch and move the single lever that tunes the Aeriola Grand and floods a room with song and speech from the broadcasting station.

Any R C A dealer will be pleased to show you the Aeriola Grand and to let you judge its wonderful tone quality for yourself.

There is an R C A set for every purse—Prices range from $18 to $350.



Aeriola Grand with stand $350

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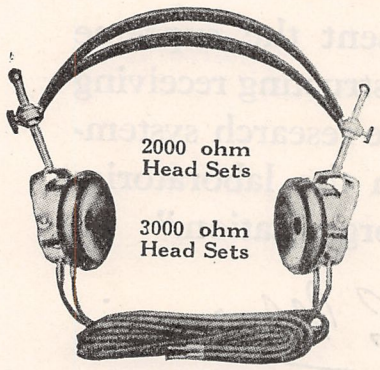
What's in Your Phones?

It is an electrical principle that the greatest effect will be produced in a magnet when there are the greatest number of ampere turns within a given space.

It is this magnetic effect, and not the resistance caused by the great length of fine wire, that makes for sensitivity in receivers. Remember, when making a purchase of Elwood Head Sets, you are obtaining receivers with not only full ohmage capacity, but with this scientific standard correctly worked out.

We have been manufacturers of Electrical and Radio apparatus since 1905.

Above is an interesting sales point that radio enthusiasts may mention to you.



We make 3 different types in 2000 and 3000 ohm sets

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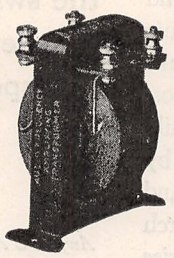
THE CHART TELLS THE STORY OF

THE AMERTRAN



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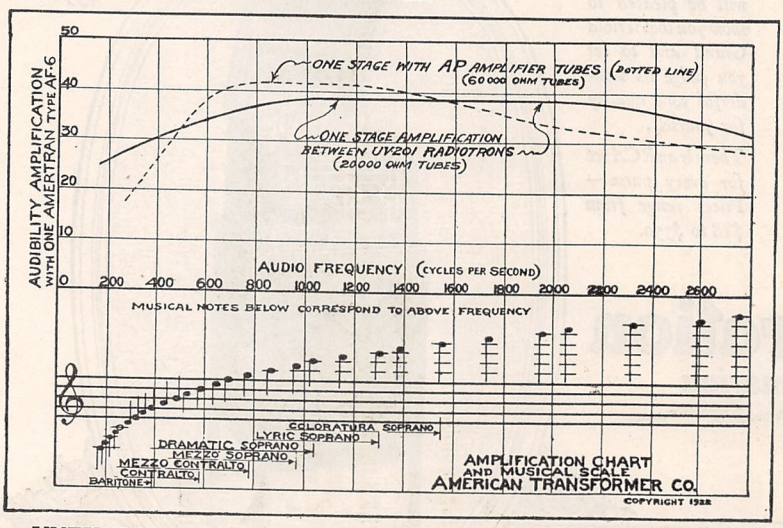
which has been recently developed to meet the critical demand of discriminating radio engineers.

NOTE the amplification curve in the chart below compared with musical scale frequencies—plotted from actual and authentic tests.

Highest Amplification Constant Over Broadest Band of Frequencies—Absolutely Without Distortion or Resonance Peaks.



UNEXCELLED IN OPERATION—UNIQUE IN CONSTRUCTION
LIST PRICE—$7.00, F. O. B. NEWARK, N. J.
Made by the
AMERICAN TRANSFORMER COMPANY
NEWARK - - - - - - - NEW JERSEY

P.M.

2:45 Major General George O. Squier, Chief Signal Officer, U. S. Army, Washington, D. C., spoke on the subject concerning "Line Radio."

3:30 Dr. Chas P. Steinmetz, Consulting Engineer of the General Electric Co., on "Radio."

Discussion.

Report of Radio Committee, Pageant of Progress, Mr. George E. Carlson, Chairman.

NEW BROADCASTING WAVE PLANNED

The Department of Commerce contemplates inaugurating a new class of license for broadcasting stations which can meet certain requirements. These stations will be known as Class "B" stations and will be authorized to use the wave length of 400 meters. The qualifications necessary for obtaining this class of license will be ready for distribution within a few days, and will also be published in the September issue of the Radio Service Bulletin.

The new wave length may be used only with specific authority of the Department in special cases recommended by the District Radio Inspectors, where interference is at a maximum. This action on the part of the Government Radio Officials, pending the passage of the new Radio Bill, will aid broadcasting materially, especially in cities and sections where numerous broadcasters are located.

Postal Radio Planes

(*Continued from page* 626)

that a plane can always be in contact with at least one field, and the fields approximately 250 miles apart.

The safety of the pilots is essential and so is the transit of the mail; therefore when a plane is damaged or delayed, radio advises of the predicament, speedifying what aid is needed and the disposition of the mail. In some instances the mail is carried only part way across by plane, trains acting as relays between flights. By this method at least two days' time has been saved between New York and San Francisco, and an experimental letter reached Salt Lake in two days.

Night flying will speed up the mails materially and night flying is planned with the aid of radio. In working out the problem of a light and compact phone transmitting set, Superintendent J. C. Edgerton and Assistant Superintendent Charles I. Stanton have been testing out a mail plane in Washington, equipped with a Naval SE 1370 transmitting set and a special six-stage amplifier. The DH4, B plane so equipped flew about Washington, maintaining constant communication with the air mail and radio headquarters in the Post Office tower and Bolling Field. From distances up to about fifteen miles the set worked well, and messages were transmitted over a distance of twenty miles, although the words were barely audible. Improvements are being made which it is hoped will improve the set and secure an approximate 125-mile radius and cut the weight 100 pounds. The set is capable of tuning to four waves, 507, 600, 800 and 975 meters, but to date only 507 Naval Air phone wave has been used. The tests, begun last week Thursday, are conducted each day from 4 to 5 P. M. and will go in an effort to eliminate "bugs," but new and improved apparatus is being designed on a lighter and simpler basis. When maximum distance and audibility are secured, a number of sets will be built for the long distance mail planes in use.

When the phones are installed it is expected that a night pilot can get his position from two radio stations, just as a marine gets his bearings from radio compass

Ask Uncle Sam He knows!

BY FAR THE BEST FOR RADIO PANELS

Uncle Sam has used Bakelite-Dilecto XX on electrical and wireless equipment in the Navy and Signal Corps for over *eight years.*

That's proof this unique material outdoes hard rubber, wood or marble. Uncle Sam does not adopt anything until he has tested everything!

Bakelite-dilecto!!

Amazingly adaptable for RADIO panelling and insulation. Gives positive and permanent insulation and utterly eliminates vibration. Imparts a professional finish to any home-made set.

Tests highest in every particular. Unheard-of dielectric strength (proved constant 5.2). Resists water, heat and milder acids. Cannot warp or swell. Finished a sleek, everlasting black. Tough and hard; yet *easily machined.*

Tell us who your electrical supply man is and we will write you where to get Bakelite-Dilecto X X cut to your exact requirements.

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LOS ANGELES....411 S. Main St.
SEATTLE.....91 Connecticut St.

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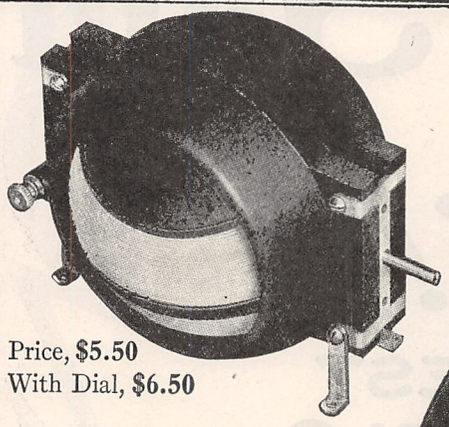
GRADE XX

COLUMBIA RADIO PARTS



COLUMBIA MOULDED VARIOMETER

A *superior* instrument with the Stator and Rotor of *moulded hard rubber*. Accurate electrical and mechanical construction throughout; designed for *best values of maximum and minimum inductance* and minimum distributed capacity. Has 3/16" shaft, with spring tension to secure electrical contact. Adapted for both base and panel mounting. All metal parts highly nickeled. An essential radio instrument of beauty and efficiency.

Price, $5.50
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stations at sea. Radio would also advise the pilot of weather and ground conditions while he was en route between stations, eliminating the possibility of accidents in landing in fog or on washed-out fields. The radiophone is used so that the pilot need not learn the code and so he can talk directly into a transmitter and not have to take his hands from the "wheel" to "send"—he talks as he drives, so to speak, and hears as well.

Is the Radio Amateur Doomed?

(*Continued from page* 624)

traffic manager says, in his preface to the rules and regulations of the Operating Department: "With the coming of high-class radiophone broadcasting we must heed the demand of citizens who desire to listen to such broadcasts. Consideration must be accorded those who desire the broadcast service and our relay work will find its periods confined to the later hours of the night. We must not encroach upon the rights of others with our relay message traffic. There were times when we could start our relay message traffic at any hour of the day or night, but with the coming of thousands of new men we had to adopt working schedules whereby each and every one was given a chance to carry on radio communication. Just so with the hundreds of thousands of citizens who find their radio pleasure in listening to concerts, lectures, etc.—we must not interfere with their sport and pleasure." With such a spirit, plus its technical ability and its long, successful experience, it would seem that the league might lead the radio public as it has the technical amateurs if it would broaden its scope.

But the rank and file are usually a few strides behind their leaders, and the preceding quotations express, I believe, the attitude of a considerable part of the radio amateur fraternity. They claim the air as Spain, England and other old world countries claimed America, by virtue of first discovery. The sad part of the story lies not in any criticism that may be made of this attitude, favorable or unfavorable, but in the fact that the great radio public cares less and less what their attitude is. The radio public wants to hear what it wants when it wants it, and every amateur who, though acting within his rights as he understands them, opens up and spoils a concert for the people in his town, hastens the day when there will be enough irritated radio users in Congress, and represented there, to consign him and his friends and his game to the pages of ancient history. It may seem unjust, but how are you going to help it, in a republic where majorities rule?

The American Radio and Research Corporation announced that it was considering suspending operation for a portion of each evening, in order to permit New Englanders to listen to New Yorkers and that kind of people. They asked for an expression of opinion from listeners and less than 10 per cent who replied thought the idea had any merit whatsoever. Those who "hated WGI with all their hearts" were strangely reticent about expressing themselves over their signatures. What is to be done in a case like that when a broadcaster, anxious to please the radio public, finds it overwhelmingly in favor of a whole evening's local program? Shall the radio public, even if its receivers are of the vintage of 1904, as alleged, be deprived of its entertainment for the sake of a comparatively small group of "radio amateurs"? Shall the decision be left to the amateurs?

In the matter of apparatus, the amateurs themselves are no more unanimous than the country is on prohibition. In the radio telephone conference in Washington one ama-

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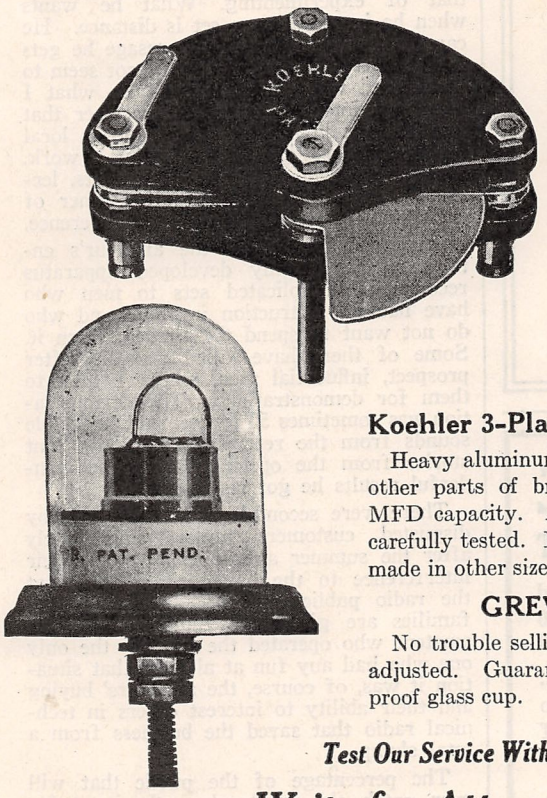

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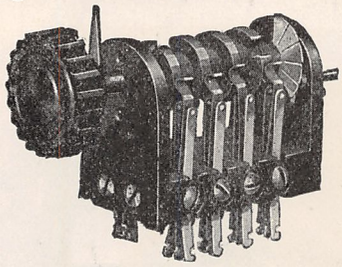

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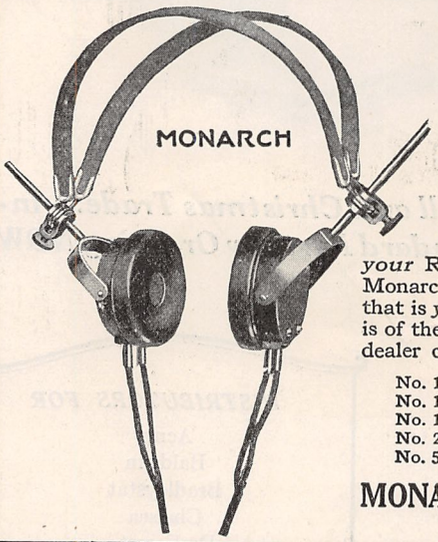

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teur assailed a type of apparatus made by another. He said it transmitted radio waves while being used as a receiver and thereby caused interference. An expert of equal standing told me after the meeting that the man who spoke had better look out, for the outfit the speaker was manufacturing himself did the same thing and he did not seem to know it. And that leads to the fact that a good many of the radio amateurs are manufacturers or dealers. Our leading organization strives to keep itself free from all commercialism and does it very well, I believe, but a number of its prominent members are about as amateurish in radio as A. G. Spalding & Co. are in baseball. A man who derives an income from a sport or pastime may be in it for the love of the game, but when his argument runs altogether to more expensive apparatus, can he expect the public to ignore the fact that he appears to derive a better profit from the higher-priced stuff?

In some ways the "amateur" idea is hindering the radio business. I speak now from observations brought up to date by a recent trip through five states, during which I talked with a lot of folks who represent the radio public. As a business radio has developed in a peculiar way. Before the broadcasting stations turned the technical sport to a popular craze, it was in the situation that the automobile business would have been in if its early promoters had been so interested in gear cutting and the chemistry of rubber that they had tried to make technicians of their customers and overlooked in their selling arguments the fact that a man with a car can take his family, his best girl, or the man he wants to sell a bill of goods to, out for a ride.

The radio amateur, even though he may have graduated into the business of radio, seems to carry with him the conviction that there is no fun for anybody in radio except that of experimenting. What he wants when he is operating a set is distance. He cares little what sort of a message he gets if it comes far enough. He cannot seem to understand why anyone should do what I did last winter, install a $25 receiver that would bring in reliably half a dozen local broadcasting stations, and just let it work, supplying the household with concerts, lectures, news, addresses and all manner of entertainment with little or no interference.

Dealers possessed of the amateur's enthusiasm for highly developed apparatus recommend complicated sets to men who have had no instruction in radio and who do not want to spend the time to learn it. Some of them have killed prospect after prospect, influential men, whom I took to them for demonstrations. The demonstration was sometimes 50 per cent unintelligible sounds from the receiver and 50 per cent stories from the operator about the wonderful results he got last week.

There were second-hand sets for sale by disgusted customers almost immediately after the summer atmospherics added their interference to the bunch of trouble that the radio public was already having, and families are giving up radio because the amateur who operated the set was the only one who had any fun at all. In that situation it was, of course, the amateurs' buying and their ability to interest others in technical radio that saved the business from a total slump.

The percentage of the public that will ever catch the amateur's enthusiasm for things technical is as small as the percentage of doctors, lawyers and school teachers in the average town. The big fellows in the business know this and the amateur is bound to lose importance in their estimation as his purchases grow smaller and smaller in proportion to those of folks who want to use, not study, radio. It still seems to be necessary for persons living far from a broadcasting station to own and operate expensive and complicated sets if they are to

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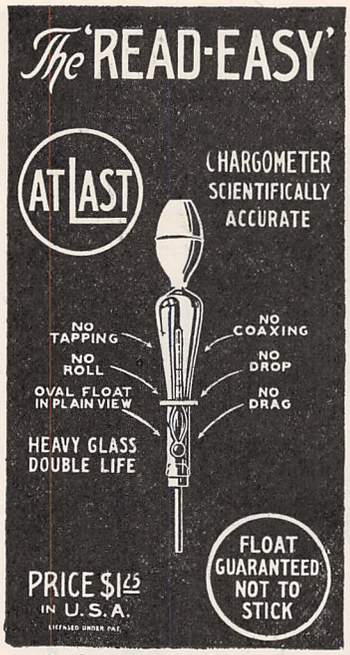

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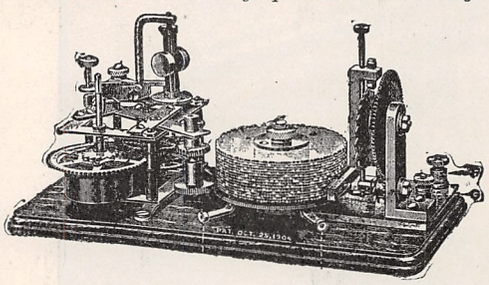

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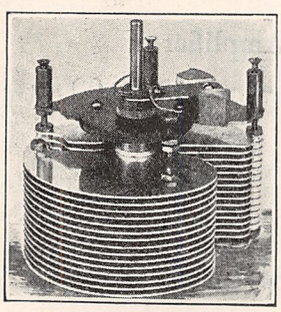

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enjoy radio at all, but the spread of broadcasters puts radio nearer and nearer to the masses. Already the bulk of our population can have an entertainment any evening with crystal detector or single-tube sets. The amateurs can break up the show if they will, but unless they all read the signs of the times as their far-sighted leaders have and keep out of the public's way, their finish is in sight.

There is a more cheerful aspect to the matter, if the amateurs can see it. There is a great, unoccupied field in radio which they could occupy and in doing so make themselves so obviously necessary to their communities that they would receive support and assistance instead of increasing repression. The public is not yet awake to radio as a utility. It knows radio as a commercial proposition like the telegraph and as a partially successful home entertainer, but it does not realize that the air is full of valuable information and that government stations could be utilized for supplying exactly what any section needed if a request should be made through the proper channels to Washington. If radio amateurs should be the first to give the public an organized radio service, receiving and publishing all information that their respective communities should have, it would be as easy for them to get quiet air for tests and relays on occasion as it is for the school teacher to get a vacation, for they would have the public with them.

One thing that stands in the way is the fact that the technical amateur does not enjoy such service nor seem to appreciate that it is worthy of his attention. If it is brought to his notice he sometimes passes the buck or finds fault about the transmission of the broadcasts. "The establishment of a copying station is always the hardest thing in amateur radio," says the man whom I have quoted so often for the reason that he so well typifies the highly developed amateur, "because it is unutterably dreary, unrewarded and unrecognized. The public accepts success as a matter of course and sneers at the occasional failures that mark all radio work." His is typically the attitude of the laboratorian toward the practical application of the very things that he develops. There should be no quarrel with that. The world needs different types of workers. But should the small percentage of men so constituted attempt the impossible task of running the whole radio public into the same mold or look down upon the rest of us?

For every one of these specialists there are a hundred potential operators who for a year or longer would handle a copying service with enthusiasm and without thinking of any other reward than the high honor of being appointed to take charge of a community receiving station provided by the Chamber of Commerce, the Rotary Club or some other public-spirited organization. Thousands of older Boy Scouts would jump at the chance. The technical amateur does not need to carry the whole load. He could offer his technical ability to help in getting things started and thereafter lend a hand only when specially needed.

The technical amateur is always ready to help anybody who wants to learn about radio. It is not generosity that he lacks. The league offers its members' services to novices, and urges amateurs to assist local jewelers in installing radio receivers to bring in time signals. The A. R. R. L. has brought about the organization and enforcement of schedules designed to give everyone a share of the time. But the man who will sit up nights and strain his ears and adjust his apparatus hour after hour to add a hundred miles to his range is not the man to initiate a service which would take him away from his experiments, unless there are strong reasons for doing so. The A. R. R. L. handles a thousand citizen messages a day free of charge as material for its relay experiments.

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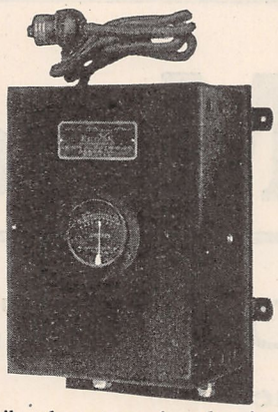

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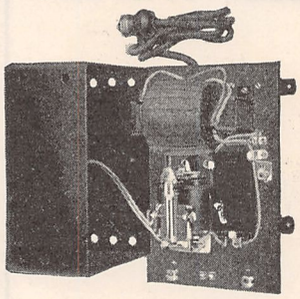

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but only, in the language of my correspondent, "Some small towns now obtain bulletin service from amateurs."

QST, the mouthpiece of the league, finds great encouragement in the fact that the number of amateurs is rapidly increasing, yet can it be doubted that every amateur who gets into the game and operates a transmitting station brings the ether nearer the saturation point and the public nearer to the point of forcing the amateur transmitters all out of the air during the time when it is most convenient for them to work?

To sum the matter up, as I see it, the radio public is in control and is no more likely to give the radio amateur the air when common folks want to listen in than it is to give the speed specialist the road. The technical amateur may do much for radio as he has in the past, but his work probably will never be fully appreciated by the public because it is technical and because eventually it is almost sure to be exploited by commercial concerns whose interest is in promoting their own business rather than the reputations of amateurs.

Amateurs may succeed in forcing changes in the transmitters of government and commercial stations, as they have in the past, and may even change the radio public's receiving apparatus, but in doing so they are more apt to be classed as meddling busybodies than as public benefactors unless they use more tact than usually comes to the surface when we ride our hobbies.

If the technical amateur sticks to the silence of his radio den, hating the home folks whose normal activities interfere with his sport, his troubles are going to multiply. But if he will spare the time to come out and mingle with the common herd, organize us and lead us until we have a unified system of government and commercial broadcasts and a receiving end in every neighborhood so that we will get the really important information from Washington, Chicago, New Orleans and San Francisco daily, before, after or between the radio shows, he is going to be a guest of honor at many a banquet and a citizen whom everybody knows and likes. And he is going to have the consciousness of leading the greatest movement of the most important period in the history of the world.

Details of an Efficient Universal Receiver

(*Continued from page* 651)

necessarily be adhered to in assembling the set, as there are several brands of reliable apparatus on the market which will prove equally as good. Much trouble was experienced in building previous sets in obtaining dials that would run true. The molded dials then available warped discouragingly. The dials on this set were turned from ¼" sheet bakelite and engraved on a machine. They are the product of a manufacturing company in Portland, Ore., and have given complete satisfaction, as they are absolutely true.

As much or more pains should be taken with the wiring as with the other details of construction. Use bare wire and make all connections rigid and *neat*. Be sure to solder all joints. It is in the wiring that so many home-made sets fall short of the commercial standard which they often approach, and sometimes surpass in other details of construction.

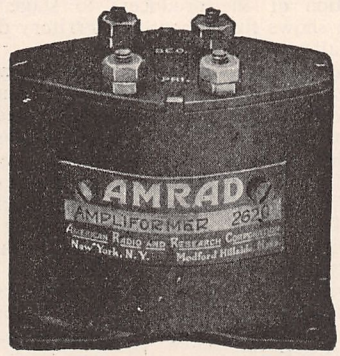
If carefully made, this set will give unfailing service and amply repay the builder for his pains. The amplifier may be limited to two stages, but I personally find three of good use with the Magnavox.

Any questions regarding this set will be gladly answered by mail, if the person desiring the information will enclose a stamped, self-addressed envelope with his request.

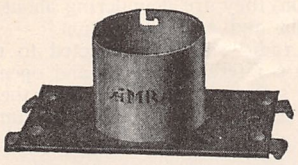
The address is 597 Montgomery Drive, Portland, Oregon.

AMRAD

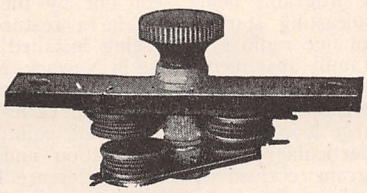
The Recognized Symbol of Superior Performance



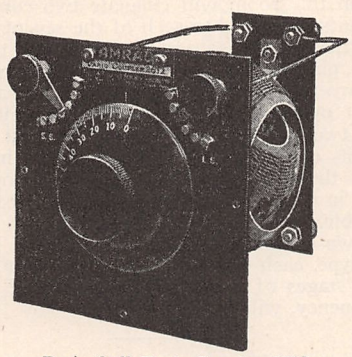
Ampliformer 2620. As illustrated, $6.00. Unmtd., $3.75



Tube Base 2164. Navy Type Design. Price $1.00



Vernier Variometer 2610. A Miniature Variometer. Price $2.50



Basketball Vario-Coupler 2612
$7.75, $8.50 or $14.50, according to type
Basketball Variometers
$6.50, $7.25 or $11.50, according to type

Use PROVEN Parts In Your Detector and Amplifying Panel

Thousands interested in Radio prefer to build their own equipment. The Amrad line offers the man of mechanical mind numerous receiving specialties of known value—products resulting from research and engineering experience in Radio antedating the late War.

For amplification, it's the Amrad RADIFORMER for radio frequency and the Amrad AMPLIFORMER for audio. These transformers were specially designed for Radiotron tubes. Comparative tests have proved conclusively 25 to 50% greater amplification *without distortion* than can be obtained in conventional designs. Bulletins R and N, sent on request, detail the exclusive features of Amrad design which make this possible. Ask your dealer for these Bulletins or write our nearest office.

Amrad Grid Leaks and Fixed Condensers are useful necessities extremely popular with the radio man who builds. The Grid Leaks are furnished in six values while there are seven capacities available among the cartridge Condensers.

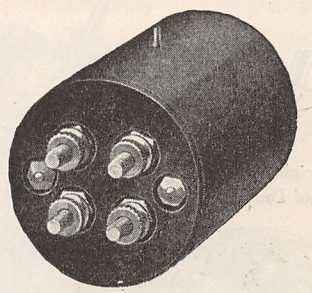
All Amrad Parts are standard equipment in Amrad Receiving Sets—Radio Products born of experience in manufacturing nearly a million dollars' worth of radio equipment to government specifications and more than as much again for the radio public. You can purchase them with full assurance of satisfaction provided they are identified as AMRAD.

Amrad Basketballs

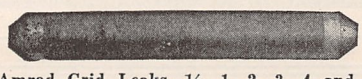
Basketball Variometers and Couplers are endorsed by radio engineers everywhere. But what we like best are letters from enthusiastic Amrad Basketball Fans in representative sections of the country—letters paying glowing tribute to the patented basket-weave windings guaranteeing low dielectric losses and maximum signal strength. There are SIX styles of Amrad Variometers and Couplers—each a BASKETBALL. Inspect the Basketball at your dealer's. Ask for descriptive Bulletin O.

For extra fine tuning the Amrad Vernier Variometer is the answer. This is a new wrinkle for tuning and "holding" C.W. It eliminates all shunt capacities. Described in Bulletin N.

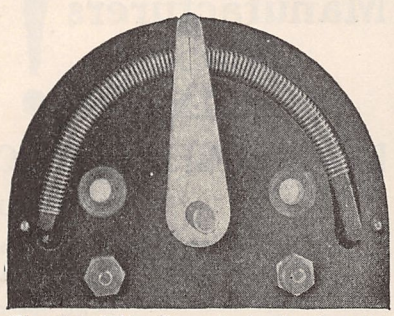
Complete Amrad Catalog listing over 80 radio products 10 cents



Radiformer 3057-1. Price $5.00
(The new Radio Frequency Amplifying Transformer)

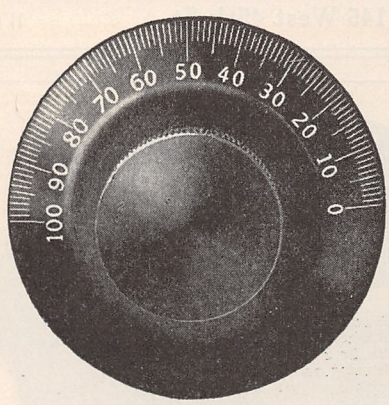


Amrad Grid Leaks, ½, 1, 2, 3, 4 and 5 megohms. Price, each, 80c



Rheostat 2621. Rugged, Ample Capacity. Price $1.00

Fixed Condenser, All Capacities, Each, 45c



Knob and Dial 2608. Price 75c
Also in 50 Divisions. Shaft Diameter, 3/16"

AMERICAN RADIO AND RESEARCH CORPORATION

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21 Park Row

General Office, Factory and Laboratory
203 College Avenue, Medford Hillside, Mass.

Chicago District Office
220 So. State St.

Warren Head Sets

THE product of a *successful* designer of Receivers.

All WARREN Head Sets are thoroughly tested and toned alike. A guarantee covers every instrument.

Case—solid aluminum.
Cap—hard rubber.
All parts highly nickel-plated.

If after two weeks' trial you can show us a *better* Head Set than the WARREN, we will gladly refund your money!

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Specialists in Head Sets and Loud Speakers

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WARREN, RHODE ISLAND, U.S.A.

Manufacturers Jobbers Dealers!

Send your Radio Needs to Us

LARGE COMPLETE STOCKS — IMMEDIATE DELIVERIES

order anything you need

If our stock does not include all you need, as a matter of service we will advise you where you can get it.

Send for our New Fall Price and Discount Schedule

Distributors For

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WESTINGHOUSE	EVEREADY	FEDERAL
CLAPP-EASTHAM	EXIDE	DEFOREST
GENERAL ELECTRIC	BRACH	BRANDES

AND OTHERS

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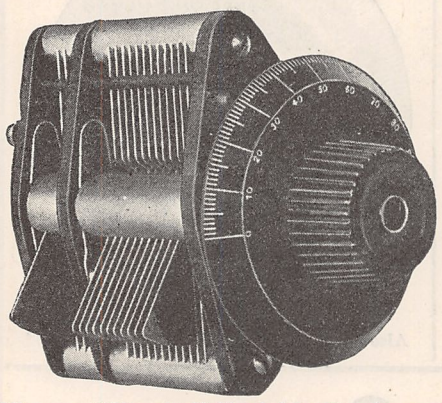
145 West 45th St. *Wholesale Only* **New York City**



Niagara "Vernier" Variable Condensers Tune Sharply and Reduce Interference

Laboratory Quality—Commercial Prices

43 plate VERNIER, without dial	$7.00
23 plate VERNIER, without dial	6.25
3 plate VERNIER, without dial	2.25
43 plate Regular, without dial	4.75
23 plate Regular, without dial	4.00

JOBBERS AND DEALERS—Write for Discounts

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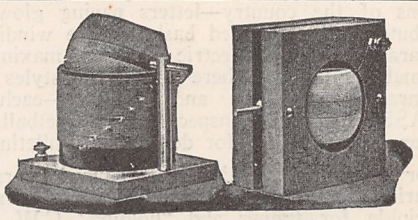


Variometers } **$3.00** each
Variocouplers }

Variotuners $5.50

Wave Length 150-1600 Meters

Completely Assembled and Guaranteed

SEND FOR BULLETIN

FREDERICK WINKLER, Jr.

304 Columbus Ave., New York, N. Y.

Radio Digest

(*Continued from page 632*)

traffic through the State offices. Wireless messages to Great Britain and Ireland will be accepted subject to the same rules as ordinary telegrams.

RADIO SHOWS IN THE SOUTH

The first of a series of Radio Shows in the Southwest is scheduled for Houston, Texas, from September 18 to 23, inclusive. Other shows will be held at San Antonio, Texas, October 9 to 15, and New Orleans, Louisiana, November 13 to 19. It is the intention of the producers to stage additional shows throughout the territory during the fall and winter.

The co-operation of the manufacturers is being asked for to make up the most extensive and up-to-the-minute exhibits and demonstrations of radio apparatus possible. Besides many novel and entertaining features within the exhibition buildings, a program as diversified and elaborate as money will buy, will be broadcasted during each exhibition week. Professional artists only will be engaged for this work.

It is also planned to set apart certain hours, during which lectures and demonstrations will be given by famous experts in radio work.

The southwest is regarded as practically a virgin field for the radio manufacturer, and, while there are thousands of fans, in the main, they are floundering about in a sea of doubt and experimentation.

The radio show is expected to not only stimulate interest in radio and open up immense selling possibilities for the dealer, but to serve as a school for the amateur as well.

APARTMENT HOUSE RADIO INSTALLATION

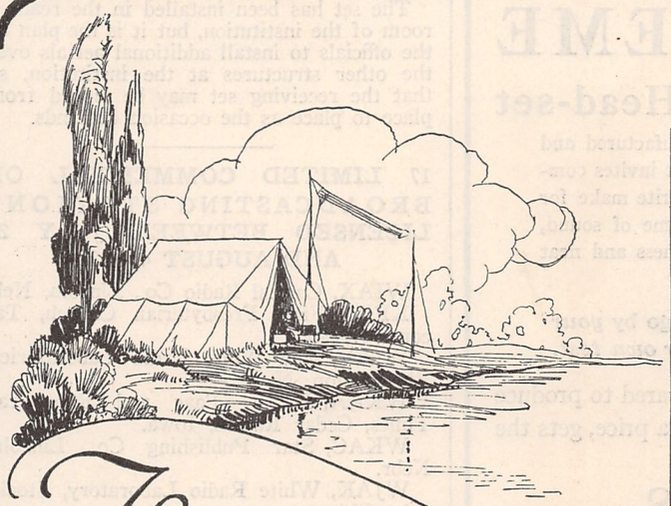
A choice of "listening in" to either of two programs being sent out by the big broadcasting stations will be a feature of an unique radio system being installed in a 72-family apartment house in Newark, N. J., by an electrical company. Two complete receiving sets will be installed, each with a large loop or directional aerial, pointed to a particular broadcasting station and the program received without interference from whatever may be coming in on the other loop.

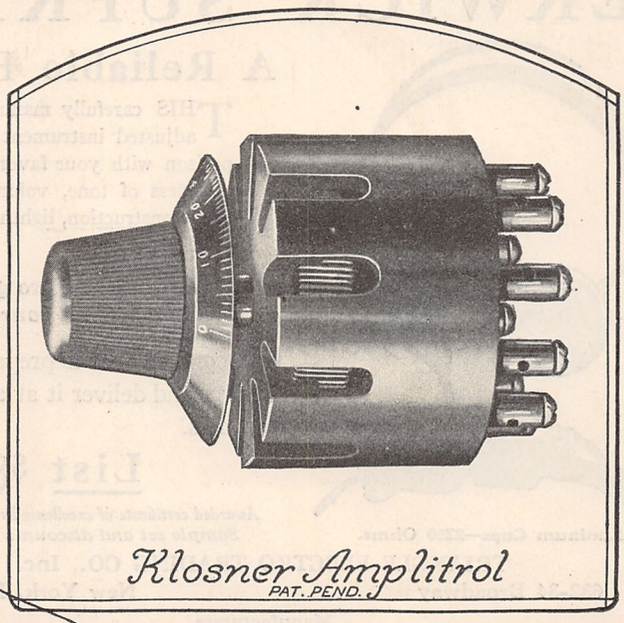
A special radio room in charge of a licensed operator will house the equipment. From this room will emanate two complete circuits connected to each of the seventy-two apartments and so arranged that the tenant may plug in his receiving set to whichever of two programs he may prefer. The apartment operator will tune in each evening to the two stations that offer the best programs or are heard the clearest and in this way the tenants will be able to enjoy the best in the ether each night with the least of trouble.

Two complete receiving sets of the R. C. A. type, each equipped with a detector tube, two stages of audio and two steps of radio frequency, will be installed.

RADIO IN THE PRISON

"Trustees" and officials at the Ohio State prison farm at London, Ohio, are now able to keep in touch with the outside world through the installation of a radio receiving set, purchased from the entertainment funds of the institution. The set, which has just been installed, will be enlarged within a few months by the addition of a transmitting set, through the use of which prison authorities hope to be able to bring about recapture of escaped convicts more quickly. The news of escape will be broadcasted immediately, to be picked up by amateurs in the vicinity,





Klosner Amplitrol
PAT. PEND.

The ideal combination for VT control without the use of jacks or plugs.

THE long looked-for has at last arrived. The new Klosner "Amplitrol" fills that long-felt radio want—that of controlling the vacuum tube circuit without the use of jacks, plugs or any additional switches. A real radio necessity. Each of your amplifier tubes deserves one. No more plugging in from one stage to the next. Simply attach your phones or loudspeaker to binding posts and turn on any stage at will.

The "Amplitrol" not only adjusts the filament to its maximum efficiency, but it automatically controls the plate circuit at the same time, thus eliminating an extra operation. Unlike an automatic filament control, the "Amplitrol" does not put a sudden strain on your filament. It provides a gradual current increase for the filament, thus prolonging its life.

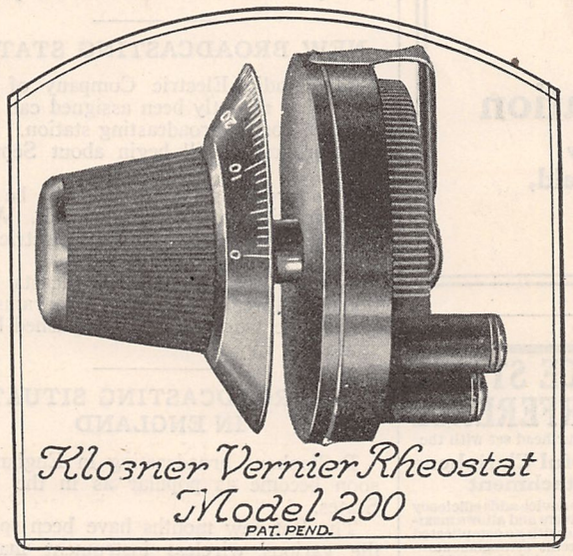
Made of moulded condensite. Contacts of phosphor-bronze. Exposed metal parts highly nickel plated. New style tapered knob, and dial correctly numbered in white lettering. Price..$4.00.

What the "Amplitrol" is to the amplifying tube, so the Klosner Rheostat is to the detector tube. The new improved Rheostat Model 200, embodies some vast changes and improvements. These are too numerous to list, but your inspection will immediately win your approval. The "Amplitrol" and the new improved Klosner Rheostat are the ideal combination for your vacuum tubes. Klosner Rheostat Model 200. Price.....$1.80.

The "Amplitrol" and the Rheostat do not employ the graphic-disc principle, but that of wire wound. This feature insures perfect contact at all times, making tuning quicker and louder and giving greater range. See them at your dealers or write for literature.

We are the inventors and sole manufacturers of the famous Klosner Vernier Rheostat Model 100, still being sold for $1.50.

Write for interesting literature on the "Amplitrol" and the Klosner Rheostats. Address Dept. OA.

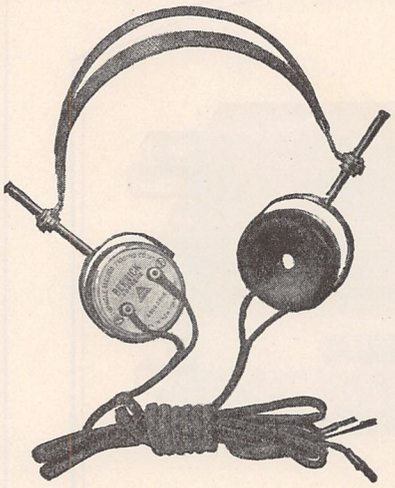


Klosner Vernier Rheostat
Model 200
PAT. PEND.

Klosner Improved Apparatus Co.,

2024 Boston Road New York City

BERWICK SUPREME



A Reliable Head-set

THIS carefully manufactured and adjusted instrument invites comparison with your favorite make for clearness of tone, volume of sound, rigid construction, lightness and neat appearance.

We are satisfied to go by *your judgment—on your own test.*

The concern that is prepared to produce quality and deliver it at a price, gets the business.

List $8.

Awarded certificate of excellence by N. Y. Evening Mail.
Sample set and discounts upon request.

Aluminum Cups—2200 Ohms.

TRIANGLE ELECTRO TRADING CO., Inc.
632-34 Broadway New York, N. Y.

Manufacturers
BERWICK SUPREME RADIO TELEPHONES

Moulded-RADIO-Accessories

Manufactured of Approved Material

Specifications Solicited

Knobs Dials Rotors
Couplers Panels Stators

International Insulating Corporation

Radio Dept.
25 West 45th St.
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LOOK AHEAD!

Men who understand and can operate radio apparatus are in increasing demand as operators and salesmen at good salaries.

We have trained thousands of successful radio men. Let us train you. Complete course covers

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Send for free illustrated booklet

Y. M. C. A. RADIO SCHOOL
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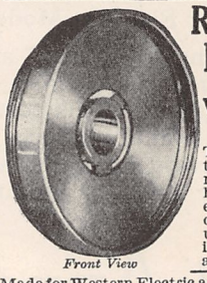
"The Best Radio School in the East"



Front View

REDUCE STATIC INTERFERENCE

Equip your head set with the
Wonderful Clariphone Attachment

This simple device adds efficiency to the receivers and allows maximum results with no complicated horns or circuit arrangements—every word modulation and tone distinction easily heard—particularly effective for music receiving. Easy to hook up — no adjustments necessary.

Made for Western Electric and Stromberg-Carlson Receivers
Price $3.00 set of two postpaid.
Stromberg-Carlson receiving sets completely equipped with Clariphones $10.50
Order direct or through your dealer.
Sole Patentees and Manufacturers
THE COLYTT LABORATORIES
(*Engineering*) 565 West Washington St., CHICAGO

who in turn will advise the proper authorities.

The set has been installed in the reading room of the institution, but it is the plan of the officials to install additional aerials over the other structures at the institution, so that the receiving set may be moved from place to place as the occasion demands.

17 LIMITED COMMERCIAL OR BROADCASTING STATIONS LICENSED BETWEEN JULY 29 AND AUGUST 4, 1922

WIAX, Capital Radio Co., Lincoln, Neb.
KFBG, First Presbyterian Church, Tacoma, Wash.
WIAV, New York Radio Laboratories, Binghamton, N. Y.
WKAA, H. F. Paar and Republican Times, Cedar Rapids, Iowa.
WKAC, Star Publishing Co., Lincoln, Nebr.
WJAK, White Radio Laboratory, Stockdale, Ohio.
WIAY, Woodward & Lothrop, Washington, D. C.
WJAM, Central Park Amusement Co., Rockford, Ill.
WIAZ, Electric Supply Sales Co., Miami, Florida.
WJAP, Kelly-Duluth Co., Duluth, Minn.
WKAD, Charles Looff, East Providence, R. I.
WJAR, The Outlet Co., Providence, R. I.
WJAN, Peoria Star and Peoria Radio Sales Co., Peoria, Ill.
WJAX, D. M. Perham, Cedar Rapids, Iowa.
KDZT, Seattle Radio Ass'n, Seattle, Washington.
WJAL, Victor Radio Corp., Portland, Maine.
WKAF, W. S. Radio Supply Co., and Wm. Schack, Wichita Falls, Texas.

RADIO TELEPHONY IN ARGENTINA

No laws have yet been passed to govern wireless telephony in Argentina, but a bill is being drafted for presentation to the next Congress to regulate the use of radio sets.

No regulations at the present time in effect prevent the sale of broadcasting and receiving sets. The latter are being manufactured to some extent locally, but of very inferior quality and sell at from 200 to 700 pesos.

NEW BROADCASTING STATION

The Radio Electric Company of Pittsburgh has recently been assigned call letters WHAF for its broadcasting station. Scheduled programs will begin about September first.

This broadcasting station will be under the direction of Mr. Parker E. Wiggin, Chief Engineer of the Radio Electric Company.

Weather reports, news broadcasts, educational features and musical programs summarize the work to be accomplished by this station.

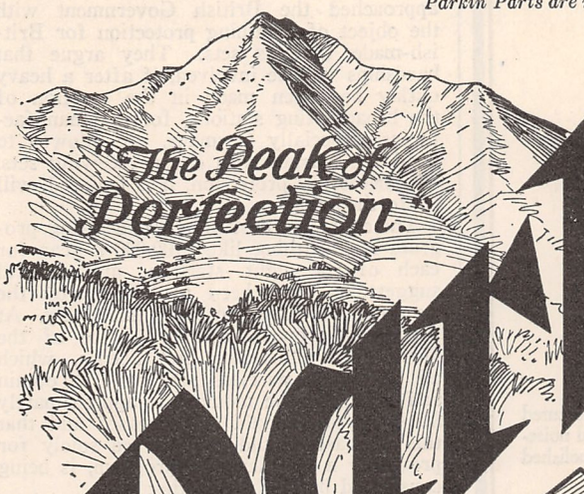
THE BROADCASTING SITUATION IN ENGLAND

Radiophone broadcasting in England will soon become as popular as in the United States.

The last few months have been spent by the various wireless instrument manufacturers in coming to a practical working scheme, the object of which is to cover the whole of the British Isles with broadcasting areas, and at the same time endeavor to keep mutual interference at a minimum.

The following towns have been selected and stations of a 1½-K.W. rating will be shortly opened and operated. The centers

Mt. Tamalpais, California, whose rugged slopes and lofty summit are plainly visible from the plant where Parkin Parts are made



Parkin parts

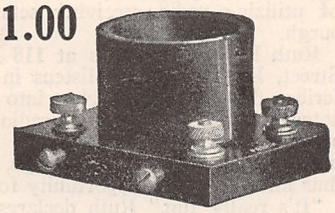
SINCE 1914

SINCE 1914

Your dealer is glad to have you choose PARKIN *"Peak of Perfection"* Radio Parts and Radio Supplies—he knows he can stake his reputation on them. For PARKIN Parts are produced by *experienced* radio manufacturing — *PARKIN since 1914.* This is the dealer's assurance of dependability as well as your guarantee of perfect satisfaction. To be sure of getting *"Peak of Perfection"* quality, demand PARKIN every time you make a radio purchase. The price is no higher. Send us your dealer's name and we will send you FREE, postpaid, the PARKIN *"Radio Buyer's Guide"* (No. 7).

"The Peak of Perfection"

$1.00

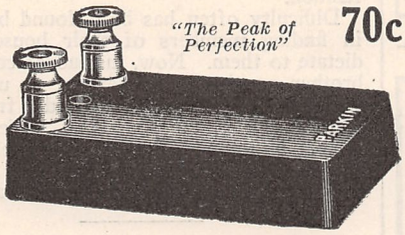


PARKIN V T SOCKET
panel or table mounting

—for maximum insulation. Moulded of genuine Bakelite, highly polished; contact fingers, binding posts, screws, and washers nickel plated. Base 2¼" by 2¾", marked for proper connections. Price includes screws for panel mounting, and holes drilled for table mounting. *Order No. 78*—price *$1.00.*

"The Peak of Perfection"

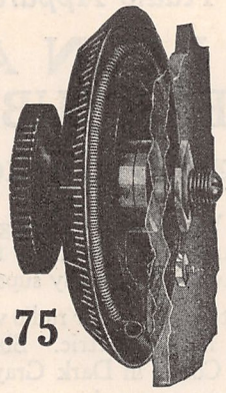
70c



PARKIN Fixed Receiving CONDENSER

Regulation type for use with receiving circuits. The binding post screws are soldered to the unit, and with the unit moulded solidly into an unbreakable Bakelite base, making a sturdy and attractive one-piece instrument. *Order No. 53*—price *70c.*

"The Peak of Perfection"



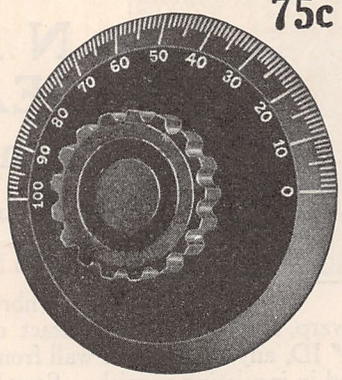
$1.75

PARKIN Dial Type RHEOSTAT
(Patented)

The resistance element is mounted in a recessed groove in the back of a 3-inch moulded Baklite dial, which saves you the cost of an extra part, gives you more cabinet space, and eliminates resistance heating from inside of cabinet. An off position is provided and a stop on the dial engages the stationary contact at the extreme positions. 360° rotation insures fine adjustment, and a brass bearing insures true running. Figures and graduations filled with brilliant white enamel. Brass parts nickel plated. Dial and knob both of die-moulded Bakelite. Resistance 5 ohms, carrying capacity 2 amperes. Only two panel holes required for mounting. Instructions with each instrument. Order *No. 77*—price *$1.75.*

"The Peak of Perfection"

75c



The PARKIN Bakelite Dial

A dial whose easy action, smooth running and positive accuracy make tuning a real pleasure. A dial which we believe is worthy the name of PARKIN and the years of radio manufacturing behind it. A standard dial of moulded Bakelite highly polished. Graduated from 0° to 180°. The graduations read from right to left for clockwise rotation, and are filled with brilliant white enamel for easy reading. The knob is of moulded Bakelite. The brass bushing is moulded into the dial to insure easy action and true running. The set screw penetrates both the bushing and the knob. Drilled for either 3/16 or ¼ inch shaft. Order *No. 767*—price *75c.*

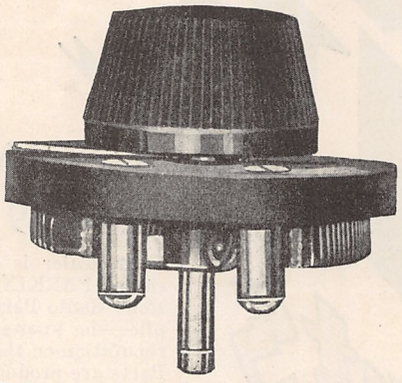
DEALERS and JOBBERS: *We want to hear from every radio dealer who has the foresight to realize that he must sell quality and give service to build a profitable business. If you are that kind of a dealer, write us, we have something for you. Ask for Catalogue No. 7.*

Parkin Mfg. Co.
San Rafael, California

OCTOBER **EMPIRE RADIO** BULLETIN

A NEW EMPIRE PRODUCT

Built up to a standard, Not down to a price



Price only 95c

Description: Resistance unit of 6 ohms, carrying capacity 1½ amperes, firmly secured in high heat insulation base. The action is absolutely smooth and noiseless. Contact lever is of phosphor bronze, pointer is hand polished nickel. Knob is of polished bakelite, knurled and tapered. Shaft takes any thickness panel.

NOTHING BETTER CAN BE HAD IN RHEOSTATS

Dealers and jobbers write for attractive proposition
Amateurs send 10c for our new and complete catalog

EMPIRE RADIO CORPORATION
Manufacturers and Distributors of Radio Apparatus
271 West 125th Street New York City

LIGHTNESS AND STRENGTH — SUPREME IN ELECTRICAL RESISTANCE — NATIONAL FIBRE & INSULATION CO.

Mr. Maker of Radio Apparatus Try

NATIONAL SEAMLESS TUBING in Large Diameters

For Vario-couplers, Variometers, Tuning Coils and wherever you use large diameter fibre tubing, this tubing is less expensive and infinitely superior.

It is a fibre tube built especially for radio work. Will not warp, shrink or swell. Exact dimensions, high dielectric. Sizes from 3″ to 4½″ ID, any thickness of wall from 3/32″ up. Comes in Dark Gray, Black, or dipped in insulating varnish. *Samples and prices on request.*

Use National Fibre for Panels

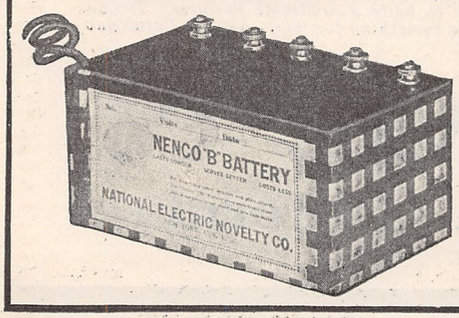
Hard, black stock, for condenser tops and bottoms, rheostat bases, bushings, etc. Let us quote on the stock, or completed parts machined to order.

Ask for Peerless Insulation

The Standard thin weight fibre or "fish paper."

NATIONAL FIBRE & INSULATION CO.
BOX 472 -:- -:- -:- YORKLYN, DELAWARE

"NENCO" "B" Batteries



THE MOST EFFICIENT MADE

Last Longer—Serve Better—Cost Less

Made In
All Standard Sizes and Voltages

National Electric Novelty Co.
53 Walker St. New York, N.Y.

are: London, Cardiff, Birmingham, Manchester, Plymouth, Newcastle, Edinburgh and Aberdeen.

The manufacturers, it is understood, have approached the British Government with the object of obtaining protection for British-made wireless sets. They argue that hardships will be involved, if after a heavy outlay has been made in the erection of the broadcasting stations, foreign manufacturers, especially Germans, are allowed to flood the market with cheap receiving sets. The necessary protection, it is believed, will be forthcoming.

The estimated cost of a broadcasting program is something like $100,000 a year for each of the eight stations, and several suggestions have been made whereby the manufacturers may be aided financially. At present a proposal that the price of the Government "listening in" license, which all possessing wireless sets have to obtain and which at the moment is approximately $2.50 a year, should be increased and that this increase should be reserved solely for providing a broadcasting program, is being considered by the authorities.

Considerable interest is now being shown in the enterprising action of the London *Daily Mail*. The publishers of this paper have undertaken the continuance of the wireless concerts from The Hague, which would soon have ceased owing to lack of funds. It is intended at present to transmit concerts every Sunday and Thursday evening between 7 and 8 o'clock British summer time. The wave used will be 1,050 meters and the power will shortly be increased to 1½ K.W. With this power the promoters are hopeful of attaining a radius of from 1,000 to 2,000 miles.

Contributed by J. E. Davies.

SHORTHAND STUDENTS USE RADIO SETS TO GAIN SPEED

A novel aid in the study of shorthand, the taking of dictation from wireless speeches and programs, is the latest means of utilizing radio receiving sets in Pittsburgh.

Ruth Baker, who lives at 118 East Ohio Street, Pittsburgh, Pa., listens in and transcribes the text of speeches into shorthand notes while enjoying the radio program broadcasted from KDKA, radio broadcasting station at East Pittsburgh, Pa., and thus finds unlimited opportunity for practice.

"It's really fun," Ruth declares. "I like to hear the wireless program and I just take down shorthand notes while I am listening to the speakers. Then, instead of having to study my shorthand after the entertainment, all I have to do is to transcribe my notes for practice. It makes study a pleasure."

The method is recommended as an excellent one by Prof. O. B. Hughes, head of Park Institute, Pittsburgh, which Ruth attends. Many other schools are advising their pupils to employ the radio in similar fashion.

Difficulty often has been found by pupils, in finding members of their household to dictate to them. Now, instead of coaxing a brother or sister into serving as unwilling dictators, or separating "Dad" from the sporting sheet, the shorthand student finds almost unlimited dictation in the eloquence of week-day speakers or the quiet Sunday morning sermon over the home radio set.

FEDERAL RADIO ACTIVITIES INCREASING

Since the establishment of the Inter-Departmental Radio Board, radio activities in several of the governmental departments and bureaus have been increasing rapidly. The Army and Navy are constantly going full tilt and increasing their official and public service almost daily, while the Post Office, with fifteen stations, is perfecting radio-

Rasco GIVES $250.00 IN PRIZES TO RADIO AMATEURS

$250.00 IN PRIZES FOR RADIO AMATEURS

THE Radio Specialty Co. today is the only radio supply house in the United States specializing exclusively in radio parts. With one or two exceptions we manufacture no complete apparatus whatsoever.

The Radio Specialty Co.—RASCO for short—manufactures some three hundred specialties which are advertised in their catalog and which have been advertised in these pages for a long period. The Radio Specialty Co. is always on the look-out for new ideas. Hence, this prize contest. There is hardly a radio instrument that cannot be built with our parts, and to prove this we are willing to give away prizes to show the other amateurs what can be done with our multiplicity of radio parts. What this apparatus or instrument will be we leave entirely to the amateur radio fraternity. Look over our catalog carefully and select the parts and pieces that you think are necessary for building the instrument or apparatus. It may be a complete receiving set or it may be any other single instrument that you may choose.

The first prize will go to the amateur who constructs a complete set or instrument using the greatest amount of "RASCO" parts illustrated in the RASCO catalog. The next greatest number of "RASCO" parts used will win second prize, etc. It is, however, permissible for the builder to buy cardboard tubing, baseboards or cabinets, nails, etc., from other sources, as some of these parts are not listed or sold by us. Naturally, the more RASCO parts are used the better chance the contestant has to win a good prize.

$250.00 IN GOLD

First Prize	$100.00
Second Prize	75.00
Third Prize	25.00
Fourth Prize	20.00
Fifth Prize	15.00
Sixth Prize	10.00
Seventh Prize	5.00

Bank Reference: Irving National Bank (Aetna Branch), New York.

Rule 1: In order to compete, it is necessary that all parts are bought from Radio Specialty Co. Keep your receipts as proof. Also the date and amount of your order.

Rule 2: The complete instrument, **which shall remain the property of the owner,** is to be sent to the Radio Specialty Co., and the instrument will be returned to the owner as soon as the prizes have been awarded.

Rule 3: As the Radio Specialty Co. does not build telephone receivers, vacuum tubes and vacuum tube sockets and other apparatus, these may be bought from other firms and incorporated in the outfit if the builder so chooses.

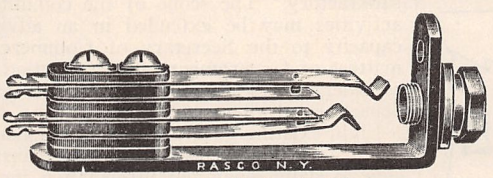
Manuscripts accompanying models should not be longer than one thousand words.

All prizes will be paid immediately upon the close of the contest and as soon as our engineers have completed the tests which will be within eight days of the closing of this contest.

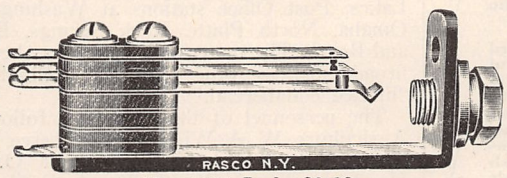
In the event of ties for any of the prizes offered, the full amount of the prize tied for will be awarded to each of those contestants so tying.

This special contest closes in New York City at our offices on November 25th and the prize winners with full description of the ideas submitted will be announced in the February, 1923, issue of this publication. Address all models, etc., to Manager, **RASCO Parts Contest, care of this company.**

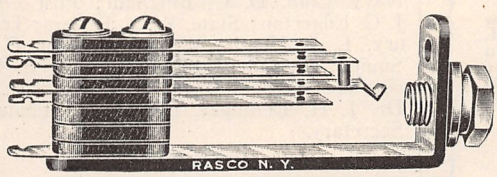
"RASCO" JACKS AND PLUGS



No. 1000 Jack, $0.75



No. 1001 Jack, $0.80



No. 1002 Jack, $1.00

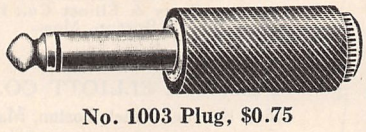
We introduce herewith to the radio fraternity the **RASCO** line of plugs and jacks. After having studied all the other plugs on the market, we have eliminated all the disadvantages of the poor ones and have incorporated in ours all of the good points of the best plugs, and have added several improvements of our own. By having our own metal factories, we are in a position to sell these plugs and jacks at a considerably lower price than those offered by other reputable concerns.

Our factory which has for twelve years made plugs and jacks for the Postal Telegraph Co. is now making these radio plugs and jacks, which although somewhat different, embody the same principles as the ordinary telephone jack. The long experience of our factory is your guarantee.

Note particularly, and we lay special stress on this, that all of our jacks are equipped with **PURE SILVER CONTACTS.** When buying plugs whether it be ours or other makes always **insist upon silver contacts.** Some concerns are selling jacks without silver contacts, which are of course worse than useless, because such contacts give rise to microphonic action, which in turn produce noises in the telephones or rooms and squeals in the loud talker.

RASCO jacks are made of the best material that money can buy, and the construction is correct, behind it being the soundest engineering practise. The springs are very heavy and the tension is right. The jacks are rugged, have positive action at all times while the silver contacts are very large, insuring absolute electrical contact. The construction of the bracket is brass, heavily nickel-plated and buffed.

Specify **RASCO** plugs and jacks and avoid disappointment. We are manufacturing three types of jacks which have proven to be the best sellers.



No. 1003 Plug, $0.75

No. 1003 Rasco Plug	Price $0.75
No. 1001 Rasco Jacks, 3 springs	Price 0.80
No. 1000 Rasco Jack, 4 springs, double circuit	Price 0.75
No. 1002 Rasco Automatic 5 spring Jack	Price 1.00

THE "RASCO" CATALOG

CONTAINS 50 VACUUM TUBE HOOK-UPS

Complete hook-ups of all important vacuum tube circuits are given in clear diagrams with complete explanation. Just to name a few. —The V.T. as a detector and one-step amplifier; regenerative circuit; De Forest ultraudion; V.T. to receive undamped and spark signals; Armstrong circuits; one step radio frequency amplifier and detector; three stage audio-frequency amplifier; short wave regenerative circuits; V.T. radio telephone; 4-stage radio frequency amplifiers; radio and audio frequency amplifier, inductively coupled amplifier; Armstrong superautodyne; radio frequency amplifier and crystal detector; etc., etc. The catalog contains 200 illustrations. On account of its great cost, it cannot be distributed free of charge. Mailed only upon receipt of

15c in stamps or coin.

Radio Specialty Co.

This business was originated with the sole purpose to cater to the amateur who has small orders. ALL OF OUR ORDERS ARE SMALL and that is why your small order will never be sidetracked by us. A trial order will make you a life customer. Order from the above illustrations. "We can only stick you once." Try us with a small order.

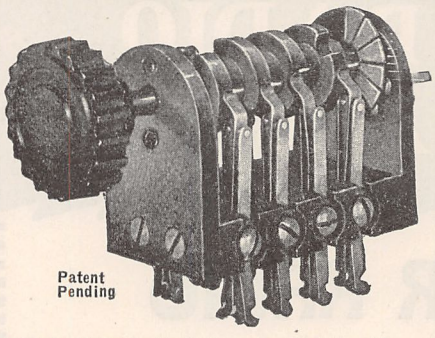
ALL GOODS PREPAID.

DEALERS

Get Our Special Proposition

98 PARK PLACE, NEW YORK CITY *Factories Brooklyn, N. Y.—Elkridge, Md.*

THE STORM-LEE MULTIPLEX ROTARY SWITCH



Patent Pending

The Perfect Amplifier Switch, Gives Complete Control of Detector and 1, 2 or 3 Stage Amplifier, Including Automatic filament control.

The **MULTIPLEX ROTARY SWITCH** takes the place of filament control jacks in the vacuum tube control panel, giving much greater convenience at lower cost. With this switch you may change from detector to any desired stage of amplification by merely turning one knob. Filaments of unused stages being automatically extinguished.

UNIVERSAL IN USE

This switch is adjustable; by loosening one nut the cams may be adjusted to meet practically any switching requirements.

SPECIFICATIONS

INSULATION—BAKELITE
SPRINGS —NICKEL SILVER
CONTACTS —STERLING SILVER

BEWARE! of imitations of our Switch. We are the originators of this type universal cam switch, protected by Patents Pending.

PRICE - - - - $5.00

If your dealer cannot supply you write us, giving his name.

DEALERS - MANUFACTURERS
WRITE FOR DISCOUNTS

STORM-LEE RADIO APPARATUS CO.
742 HIGHLAND AVENUE NEWARK, N. J.

An important announcement concerning

THE NEW EASTERN CLASSIC—EDA-4

A COMPLETE receiving unit equipped with three stages of amplification, set up in a beautiful mahogany cabinet similar in construction and design to the talking machine.

ONE of the radical improvements made is a loud speaker within the cabinet, thus keeping the entire unit intact. The New Eastern Classic will make a beautiful and practical addition to the home, and the price is well within the reach of all..... $125.00

Attractive discounts to dealers and jobbers

Manufactured by

EASTERN RADIO MANUFACTURING COMPANY
122-124 Fifth Ave. New York, N.Y.

DEPEND ON CRAMER RADIO

SPECIAL
For 30 Days—This $80 Receiver for Only $45

The CH5 receiver needs no introduction. Judged by any standard it is without equal anywhere. Simple in control; handsome in appearance; super-efficient in operation. Includes in its 150 to 3000 meter range, amateur, commercial and Navy waves, special land stations, ship stations and Arlington "time." Employees' latest inventions. Especially efficient for radiophone concert reception. Guaranteed in writing for one year. Regular price $80—and worth it. **SPECIAL PRICE ONLY $45.**

ORDER ONE NOW!

Send cash only—no CODs. Only one sold to a customer.

W. R. Cramer Co., Dept. 2 Omaha, Nebr.
"Pioneer Radio Manufacturers"

BE A RADIO WIZARD

Have your set the best. Make the other fellows look up to you as a radio expert.

It's easy when you have the Standard Radio Encyclopedia, by A. Howland Wood, Ex-Navy Instructor and Radio Engineer. Explains every instrument plainly. Tells how they work. Shows how to build, hook-up and operate. Nearly 100 illustrations, wiring diagrams etc. Written in plain English that clearly explains the most difficult technical terms.

You need this book to really know radio It only costs $2. 0 postpaid. Your money gladly returned if you are not *absolutely satisfied.* Order today from Perry & Elliott Co., 146-D Summer Street, Boston, Mass.

- - - - *EASY ORDER BLANK* - - - -

PERRY & ELLIOTT CO.
146-D Summer Street, Boston, Mass.

Enclosed is $2.00. Send me the Standard Radio Encyclopedia. If I'm not absolutely satisfied, I can return it and get my money back.

Name_____

Address_____

phone broadcasting and planning control of its cross country air mail planes. The Public Health Service and the Bureau of Education now expect to open broadcasting services for the dissemination of information and educational matter.

A little while ago the Veterans' Bureau began weekly broadcasting of want ads.; Secretary Davis wants a labor radio news service, and the Department of Commerce has just authorized its thirty-three co-operating offices to arrange with local broadcasting stations to release all cable and radio information on foreign markets in the form of a daily world survey.

Shortly you may expect to hear interesting items on foreign trade and commerce emanating from broadcasting stations at Akron, Atlanta, Baltimore, Boston, Bridgeport, Chattanooga, Chicago, Cincinnati, Cleveland, Columbus, Dallas, Dayton, El Paso, Indianapolis, Los Angeles, Milwaukee, Newark, New Orleans, New York, Norfolk, Omaha, Pensacola, Philadelphia, Pittsburgh, Portland, Richmond, Rochester, San Francisco, St. Louis, Seattle, Syracuse and Manila.

The Inter-Departmental Committee, which acts on government priority in broadcasting, when the Naval stations are used, has before it a large number of requests, as practically every governmental department has found radio beneficial to its operation, if not essential.

On August 4 the Assistant Secretary of the Treasury will employ the Naval Radio Station at Anacostia to broadcast a message to the U. S. Coast Guard on the 132nd anniversary of its creation.

GOVERNMENTAL BROADCASTING COMMITTEE

A recently organized Inter-Departmental Committee now advises Secretary Hoover regarding the priority of Government material to be broadcasted and submits schedules of operation.

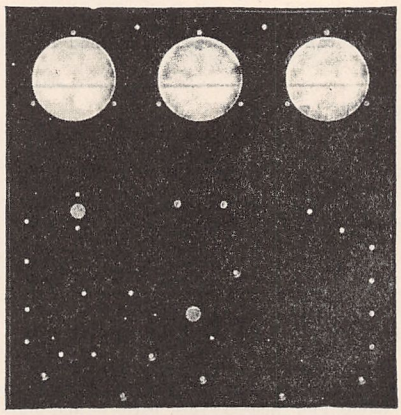
The committee recognizes the principle that radio must be used primarily for types of service that cannot be as satisfactorily conducted by other means of communication, and therefore radio broadcasting should not be used in general where wire telegraphy or telephony or printed publication would be as satisfactory. The scope of the committee's activities may be extended in an advisory capacity to the Secretary of Commerce in matters of Government radio regulation and considering all radio questions of interdepartmental interest.

Eight existing governmental stations designated as primary stations for the transmission of daily news and information include Naval stations at Arlington and Great Lakes, Post Office stations at Washington, Omaha, North Platte, Rock Springs, Elko and Reno. The material sent out may be rebroadcasted by other stations licensed as "limited commercial."

The personnel of the committee follows: Agriculture, W. A. Wheeler; Commerce, Dr. S. W. Stratton, Chairman; Interior, O. P. Hood; Justice, S. Ely; Labor, A. E. Cook; Navy, Com. D. C. Bingham; Post Office, J. C. Edgerton; State, W. S. Rogers; Treasury, L. J. Heath; War, Maj. Gen. G. O. Squier; Bureau of the Budget, E. P. Perrill; the Shipping Board, F. P. Guthrie; and Dr. J. H. Dellinger, Bureau of Standards, Secretary.

PUBLIC HEALTH BROADCASTS

The Public Health Information Service by Radio, the only national education by radio in the world, was back on the air through NOF, the Naval Radio Station at Anacostia, D. C., at 7.45 o'clock August 8. This service, together with all voice broadcasting through Naval stations, was temporarily suspended on April 15 in order to effect a reduction in interference pending



CONDENSITE CELORON

Sets a New Standard in Radio Panels and Parts

This strong, handsome, jet black, insulating material gives you a surface and volume resistivity greater than you will ever need and a beauty that will make your set the envy of your friends. It is the ideal material for making radio panels because it machines readily—engraves with clean cut characters and can be finished with a high natural polish or a rich dull mat surface.

If you want the highest type panel you can obtain—a panel made from a material approved by the Navy Department Bureau of Engineering—a panel that will give you continued satisfactory service—insist upon a Condensite Celoron Panel.

Make Your Next Panel of Condensite Celoron

If your local radio dealer cannot supply you with a genuine Condensite Celoron Panel get in touch with us direct. We'll see that you are supplied.

An Opportunity for Radio Dealers

Condensite Celoron Radio Panels offer a sales opportunity unequalled to the live wire dealer who is keen on building business on a quality basis. Write us today for our special Dealers Proposition and let us give you all of the facts.

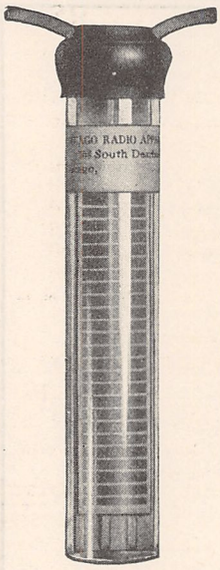
Diamond State Fibre Company

Bridgeport (near Philadelphia), Pa.

Branch Factory and Warehouse, Chicago

Offices in Principal Cities

In Canada: Diamond State Fibre Co. of Canada, Ltd., Toronto



"CHI-RAD" APPARATUS

New Storage "B" Battery

At last a real Storage "B" Battery for your radio set. Can be used on receiving apparatus as source of plate voltage on both Detector and Amplifier tubes. Ideal as plate potential on small Radio Telephone or C.W. Transmitters. When discharged do not have to be discarded as with ordinary "B" Batteries, but can be recharged again and again exactly like your "A" Battery.

SPECIFICATIONS

Cut one-half natural size.
Voltage per cell, 2 volts.
Pasted plates, ready formed for use. This means long life, battery ready for use upon the first charge given.
High ampere hour capacity—will operate one detector tube over 1000 hours with one charge. Shipped dry with simple directions for preparing the electrolyte.
NOTE:—A 22-volt battery of these cells costs but $6.00 complete with base.

"GIVE US YOUR BUSINESS—
WE'LL GIVE YOU SERVICE YOU WILL LIKE"

DEALERS

Write for discounts and territory on this new item—the demand will be heavy. Chicago Amateurs:—Come and inspect this battery and our general stock of Radio Apparatus—largest in the Middle West.

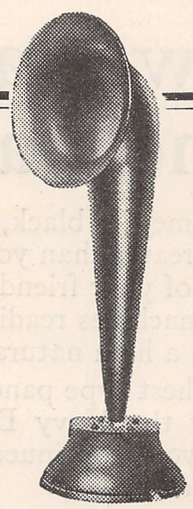
Price per cell, $0.40
Add PP on ½ lb. per cell

CHICAGO RADIO APPARATUS CO., Inc.

415 So. Dearborn St. CHICAGO, ILL.

By All Means Use a GOOD Horn—

Standard Radio Horn



Patent Applied For

The Horn Illustrated
7″ Bell, 19″ High
Rubberoid finish only. Will take all makes of receivers. No air pocket. *Designed* to give proper amplification. Heavy material to avoid *blast.*
No. 17
Price $7.50

SPECIALLY DESIGNED TO FIT ANY RECEIVER—HEAVY MATERIAL, NO BLAST—RUBBEROID ENAMEL FINISH

Your Dealer Will Supply You.

Other Horns:
14″ bell, 23″ high—No.114 } $12
5″ bell, 14″ high—No. 15 } $5

Standard Metal Mfg. Co.

237 Chestnut St.
Newark, N. J.

MANUFACTURERS! Let us quote you prices on special horns to meet your requirements.

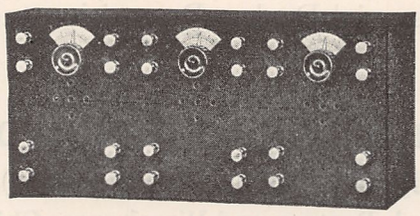
Our Radio Department is conducted by electrical engineers, which assure you dependable and highly efficient Radio equipment, either in complete sets or separate units, such as Head Receivers, Variocouplers, Variometers, Cabinets, Detectors, Antennas, Rotary Spark Gaps, Sliders, Panels, Dials, Knobs, Condensers, Grid Leaks, Contacts, Galena Crystals, etc.
We especially recommend our popular Receiving Set, RESODON, which is one of the most desirable outfits for the home, club, etc. This set comes in a beautiful mahogany finished cabinet. Write for literature.

R.E.S RADIO ELECTRIC SERVICE — PAUL G. NIEHOFF & CO. — CHICAGO ILLINOIS — MANUFACTURERS

PAUL G. NIEHOFF & CO., Inc.

Electrical Laboratories and Manufacturers

238 E. Ohio Street, Chicago, Illinois



Detector and Two-Stage Amplifier } $22.50
Detector Panel and Cabinet - - $5.50
(Less batteries and tubes)
2000 Ohm Receivers, $5.00
Superior Crystal Receiving Set, $4.75
Attractive dealers' proposition

Steinmetz Wireless Mfg. Co., Inc., 5706 Penn Ave., Pittsburgh, Pa.

decision on a government radio telephone policy. The development of a radio policy progressed to a point where it was possible for the Public Health Service broadcasts to be resumed. After this educational service was suspended, hundreds of letters were received from operators all over the eastern half of the United States asking that the public health broadcasts be continued.

"While we regret the temporary suspension of this service since April 16," an official of the Public Health Service said, "we realized the necessity for a government radio policy and appreciated fully the wisdom of suspending service until a government policy could be established and a program for avoiding interference devised. The letters received indicate that the broadcasting of educational material for the consumption of the general public has met with popular approval."

With the resumption of broadcasting public health messages through NOF, the station through which the Public Health Information originally began, stations cooperating with the Public Health Service in spreading the "gospel of health" number seven, including WGI, at Medford Hillside, Mass.; CKAC, Montreal, Canada, releasing in both French and English; KDKA, East Pittsburgh, Pa.; WRK, Hamilton, Ohio; 7XF, Portland, Oregon; and KFC, Seattle, Washington.

Commencing August 8th, these Public Health broadcasts were released through NOF, on Tuesdays and Thursdays at 7.45 p. m., Eastern Standard Time, on a wavelength of 412 meters. A lecture on Cerebro Spinal Meningitis or Spotted Fever by Louis Jay Heath was broadcasted from KDKA recently and will soon be put on at the other stations.

DISABLED VETERANS AT CAMP LOGAN HOSPITAL ENJOY RADIO

Mrs. H. D. Morse, president of the Houston War Mothers, visiting the United States hospital for disabled war veterans at Camp Logan recently with Congressman Dan Garrett, came upon a boy in ward No. 1 sound asleep with radio phones securely clamped on his head.

"What's this?" said Congressman Garrett.

"Why, they have the sick ward radiophones working," said Mrs. Morse.

A few minutes later while Mrs. Morse and Congressman Garrett were still at the bedside, the disabled soldier boy stirred, a smile spread over his face as sleepy eyes opened.

"What are you doing, going to bed with the radio nowadays?" asked Mr. Garrett.

"Sure I am. I didn't want to miss the afternoon concert. Thought I would like to take a little nap, but just to make sure that I wouldn't sleep too long, put on the ear phones, thinking the music, when it came in, would awaken me. This thing sure is great, I'll tell the world," the boy continued.

And as Mrs. Morse and Congressman Garrett went on through the ward they found other boys with phones at their ears listening in.

Mrs. Morse and Mr. Garrett, inspecting the hospital, in ward No. 1, where the patients from the surgical rooms are taken, and in ward No. 20, in which the boys are confined to their beds with tuberculosis, found wires strung along the walls with binding posts placed at the head of each bed. Here radio ear phones could be hooked in for the soldier boy who might be occupying the bed. There were 50 ear phones in use. The wires extended out into the wards from the nurses' room at one end of the ward. In this room was found a nurse tuning a receiving set for the entertainment of the bed patients.

The receiving sets are one tube Carona detectors, to each of which is added a two-

stage amplifier. That this detector and amplifier "will carry the load" was proven.

It was a nice job of radio engineering that was done. M. R. Snapp, radio engineer, did the work, and to say that he is proud of the job is putting it mildly. The telephone receivers are hooked up in series and so arranged that all will get the music, those farthest away from the detector as well as those nearest to it, with the same clearness and volume.

The fact that one of the boys, unable to sleep one night, caught a broadcast message from Los Angeles, Cal., proved the possibilities of the arrangement. This message was caught about midnight. One of the patients in ward 20, who is able to be up and about a little, was unable to sleep, so the nurse let him go into the room where is installed the detector, to see what he could pick up. He had had some experience with radio and was able after a little to pick up far away messages. After listening for some time, he discovered that messages were being broadcasted by the Bell Telephone station at Los Angeles to its receiving station on Catalina Island. The air that night and at that hour, for the summer time, was unusually free of static.

And that is just one little incident of the first week's use of the radiophones in the two-bed patient wards. Every afternoon and evening the concerts, the news and the baseball scores that have been sent out from Houston stations have been caught.

Those who have been to Camp Logan and have seen the terrible tiresomeness of nothing to do all the day through know what that means to the poor disabled boys lying there. The other many thousands who have not been there possibly will never realize how wonderful the radio installation is.

"I wish," said Mrs. Morse, "that I could get over to the people generally what this means to the poor fellows lying out there bedridden.

CABINETS FROM WALL-BOARD

I have just completed a radio receiving station and I wish to describe the manner in which I made a cabinet for my set.

My instruments are all mounted on a wooden panel, although I think a composition panel could be used as well by using a little smaller screw.

There are four good reasons for using wall-board in making cabinets.

1—It finishes just as well as a piece of wood.

2—It is much lighter than wood.

3—It is easily assembled and disassembled, making the rear of the panel readily accessible for inspection or repairs, by removal of several small screws.

4—It is much less expensive than wood, especially if the panel is of an odd size.

Wall-board is generally sold in large sheets, but I picked up several odd pieces in a hardware store for a few cents. I cut two pieces of board the height of the panel and as wide as the base for the two end pieces, and then secured these two pieces with small brass flat head screws.

In cutting the board, I very carefully cut it entirely through, otherwise it would have left a rough edge. I then cut a piece for the back, measuring from the outer edges of the end pieces, and screwed it fast; I also cut a piece for the top, large enough to cover all edges. To finish the cabinet, I applied a coat of Jap-A-Lac combination stain and varnish, mahogany color. When this first coat had dried thoroughly, a second coat was applied and left to dry.

With a piece of very fine sandpaper I smoothed the rough spots and rubbed the cabinet down with pumice stone powder on a damp cloth.

After another coat of the same Jap-A-Lac had been applied, the cabinet was complete.

Contributed by EDWARD H. BUCHER,
Harrisburg, Pennsylvania.

DUO CONDENSERS

Duo condensers are made for those who appreciate better apparatus. They are made in the following sizes and styles:

DUO— 3—Pancake	$2.25
DUO— 5—Pancake	2.50
DUO—13—Pancake	3.00
DUO—23—Pancake	3.50
DUO—23—Straight	4.50
DUO—43—Straight	5.75
DUO—23—Vernier	6.00
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Larger condensers made especially for use in the Super-Regenerative circuit.

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Send two cent stamp for circular

Dealers Note—If your jobber cannot supply you order direct

The Radiobat Storage "B"

contains the first successful semi-solid electrolyte. It is a real rechargeable 22-volt storage battery that eliminates "B" battery replacement expense. Write for information to—**MULTIPLE STORAGE BATTERY CORP., 350 Madison Ave., New York City.**

Dealers—Everywhere

Please Note

Very many dealers have been agreeably surprised to find that they are more than paying their "overhead" expenses through taking subscriptions to **Science & Invention** and **Radio News.**

The increasing demand for these magazines has been steadily growing for many months, and your patrons will appreciate the privilege of leaving their subscriptions with you.

For details and subscription blanks write Mr. C. J. Wolfe, Experimenter Publishing Co., 53 Park Place, N. Y.

Radio Company

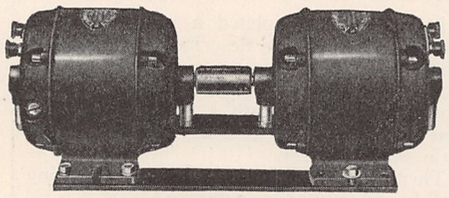
FOR SALE

WELL-KNOWN and long established Radio Corporation, manufacturing a line of popular instruments and owners of a number of patents, tools, dies, trademarks, etc., as well as a large stock of goods, is for sale. This is an opportunity to acquire a going business that can be easily and quickly developed into one of the biggest of its kind in the industry. Write for full particulars.

Box 800, care of *Radio News*, 53 Park Place, N. Y.

Battery-Charging Motor-Generator

$35.00



For charging 6-volt "A" Batteries. Has ¼-horse-power, 110-volt, 60-cycle A. C. Motor, which we guarantee for one year. Best value ever offered for..... **$35.00**

Other Bargains f. o. b. Chicago

Synchronous Motor for operating spark-gap, ⅛ horse-power, 110 volt, 60 cycle, A.C.—guaranteed for one year..... **$20.00**

Combined Motor-Generator, with low voltage for charging "A" Batteries and 500 volts for broadcasting. Motor is ½ horse-power, 110 or 220 volt, 60 cycle A.C. Generator, ½ horse-power D.C. Guaranteed for one year..... **$100.00**

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Grinder and Buffer, with ¼ horse-power motor, 6-inch abrasive wheel and 7-inch cotton buff..... **$25.00**

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Send cash with order, as these low prices do not permit of bookkeeping or collection expense. If not satisfied, money will be refunded on return of purchase within 30 days.

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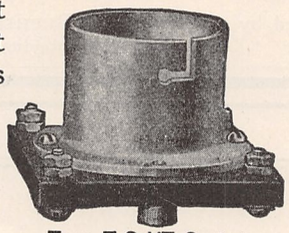
Don't Growl—

If you've used inferior equipment, and can't get results. It's not too late to throw it out and start over—with *Ace* material. If you have put up with poor service the past season—get started right this fall with *Ace* apparatus. Our socket illustrated herewith is a suggestion. Not a molded proposition to melt at the first touch of a soldering iron, but a base of ¼" solid sheet Formica, with die cast shell and absolutely guaranteed. Grid leak incorporated in socket base—adjustable to suit tube—and the price as low as consistent with highest quality. We make complete receiving sets and numerous small parts—literature on request.



Type T-S VT Socket
$1.50 with Grid Leak

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Quantity production enables us to supply the following radio parts at the lowest possible prices:

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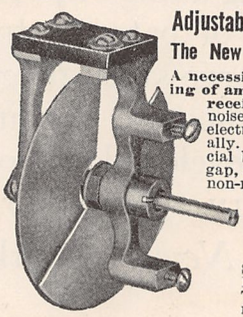


Adjustable Vernier Condenser
The New "WHITE" Type 1VC

A necessity for the sharp tuning of amateur and broadcast receiving sets. Absolutely noiseless. Highest grade, electrically and mechanically. Superior features, special bearing, adjustable air gap, no contact springs, all non-magnetic materials.

Price, postpaid, $2.50

Special proposition for Dealers and Jobbers. The best selling device now on the market.

The O. C. WHITE COMPANY
15-21 Hermon Street, Worcester, Mass.

Insure your copy reaching you each month. Subscribe to Radio News—$2.50 a year. Experimenter Publishing Co., 53 Park Place, N. Y. C.

"The installations we have made have cost us more than was first anticipated. We now have a receiving set with loud speaker in operation in Red Cross Hall for the boys who are able to be up and visit there; then there are the two receiving sets just installed, one in ward No. 1, surgical ward, and the other in ward No. 20, one of the two tubercular wards. With the wiring that had to be done, and an ear phone for every bed that had to be procured, the cost of the receiving set was a small part. However, there is still some money left in the fund that Houston people so generously gave to the War Mothers for this purpose, and with other money, which we feel sure we can get, we plan eventually to have every ward where there are bedridden patients fitted up as we now have the surgical and tubercular wards."

Every one at the hospital is enthusiastic about the radio sets installed. The nurses say it is the greatest thing that could be done for the boys.

Colonel R. L. Cook is enthusiastic. Ever since he has been in command at Camp Logan he has made a specialty of trying to provide for the comfort of the disabled men as well as to give them the best treatment that medicine and surgery render.

"And this thing will add wonderfully to their contentment out here," he said, referring to radio.—*From the Houston Post.*

RADIO AND THE WHISTLING LANGUAGE OF THE CANARY ISLANDS

American manufacturers of radio broadcasting or receiving devices might just as well pass up the Canary Islands as a market for their instruments, in the opinion of American Consul F. A. Henry at Teneriffe. There is not a chance, says the consul, particularly on the remote island of Gomera, to compete with the "whistling language" of the natives. The inhabitants of this island by use of a system of whistling signals can convey bits of news and information over considerable distances with great rapidity. The system dates back hundreds of years, says the consul's report, consequently radio telephony is practically unknown.

KILLED WHILE ERECTING AERIAL

Recently in Cleveland, Ohio, a father, 48 years of age, and his son, 15 years of age, were killed in a tragedy brought on when an aerial touched a 2,200-volt wire. In a hurry to set up a receiving set to hear a concert the young son, with the aid of another boy, who was seriously burned, had attached the aerial to the chimney of his house, and in doing so threw it over a high-tension wire. Not heeding the caution of other persons to tie a rope to the aerial, the young men clutched it. In the meantime friction of the aerial had rubbed off the insulation of the electric wire, a flash, the youth was killed instantly, and his father, who rushed to save him, died within a few minutes. This fatality should serve as a warning to others to be extremely careful in avoiding high-tension wires, and for that purpose this narrative is published.

—*Radio Service Bulletin.*

JACKIE COOGAN MADE HONORARY MEMBER JUNIOR RESERVE POST

A Junior Naval Reserve Post is being organized in Boston to which has been given, with the Mayor's consent, the name, James M. Curley Post. To this Post Jackie Coogan, the juvenile star of moving pictures, has been elected an HONORARY CADET member, and has been so notified. A telegram received at National Headquarters, 2180 Broadway, New York City, from Jackie Coogan, himself, rings true in the following words:

"You bet I accept, and I will do my level best to be as brave and true an American as the rest of the members of the James M. Curley Post. Yours awaiting orders, Jackie Coogan."

To Lieut. Minor M. Farleigh, Radio Engineer, Headquarters Staff, U. S. Junior Naval Reserve, is due the credit of erecting the first loop type aerial and one of the first amateur aerials in the United States.

In 1903 when a mere boy he was greatly interested in wireless telegraphy and in June of that year erected a loop aerial planned in 1902. He was at that time a resident of Indianapolis and connected with the Hercules Electric Co. There were no amateurs in that city or in that part of the country. The best to be heard through the ether was atmospheric electricity. Young Farleigh was laughed at for his efforts to pick up signals from the steamers operating on the Great Lakes with his coherer detector and particularly so when he built a sending outfit and sent signals a distance of one hundred feet to prove his receiving set was functioning properly.

As many Boy Scouts gravitate into the Junior Naval Reserve, when they reach their 14th year, the Executive Board of the Reserve has recently decided that Boy Scouts who have attained the rank of Eagle Scouts, will be commissioned as Ensign, on enlisting in the Reserve. They will be assigned to Post units where they will have the opportunity to develop their "officer material."

Naval Submarines to Have Long Range Radio Sets

By CARL H. BUTMAN

Radio engineers of the Navy Department have been so successful in the development of a special radio telegraphic transmitting and receiving set for submarines, that 59 new sets have been ordered. They will be improvements on the experimental set installed on the S-50 which paid a visit to Washington recently, and was said then to be one of the best equipped submarines in the world. The sets will be constructed on confidential specifications drawn up by the Radio Section of the Bureau of Engineering, based on experimental sets building at the Washington Navy Yard.

Approximately $300,000 has been saved on paper—not an actual saving because the Navy did not have the money to save. What the radio experts accomplished, however, is a remarkable saving, because practically new and very excellent long-distance sets will be available for all the big submarines at a very small cost. By redesigning and remodeling old apparatus, barring a few small innovations and parts, the naval radio experts have built up an entirely new standard submarine radio set, better than that on the S-50.

The results in radius of action, Rear Admiral Robison, Chief of the Bureau of Engineering, says, are twice what the radio men hoped for when they began the experiments some months ago. In other words, instead of a radius of about 100 miles, the U. S. N. subs will have a radius of radio transmission better than two or three times that distance in ordinary day-time communication.

The first set was installed on the R-22 and the resulting experiments proved that an excellent practical submarine set had been evolved by remodeling surplus apparatus and scraps of present equipment. New apparatus manufactured by commercial concerns along the lines of the perfected specifications would have cost the Navy in the neighborhood of $5,500 per set, instead of $500, the estimated cost of remodeling and assembly. Fifty-nine times the difference is $295,000—saved.

Another remarkable feat accomplished by the Navy was the perfection of the details

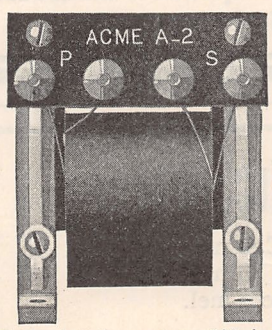
Putting the "howler" to sleep

THERE'S more than one "howler" to put to sleep these days. Your radio set can put on the greatest squalling and howling demonstration you ever dreamed of. The surest way to stop this howling and keep it peaceful is to add an Acme *Audio* Frequency Amplifying Transformer.

Most any amplifying transformer can magnify the incoming sounds, but it also amplifies the howling and distortion of stray fields in the circuit. Acme Transformers with their specially constructed iron cores and coils eliminate this disagreeable feature and it only takes five dollars to buy one.

Acme assures your receiving a large volume of sound that possesses the natural tones so lacking in the ordinary receiving set. Then, too, you will want the Acme *Radio* Frequency Transformer which costs the same as the Acme *Audio* Frequency Transformer. It can be used on both crystal detector and vacuum tube sets. It greatly increases the range of either.

You can buy either transformer at your nearest radio store or write the Acme Apparatus Company (pioneer transformer and radio engineers and manufacturers), Cambridge, Massachusetts, U. S. A. (New York Sales Office, 1270 Broadway.) Ask also for interesting and instructive booklet on the use and operation of amplifying transformers.



Type A-2 Acme Amplifying Transformer
Price $5 (East of Rocky Mts.)

ACME
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Operators who take advantage of **Parado Offers** save in original cost of apparatus and always get equipment that is "First Tested—Then Sold."

We carry complete stock of apparatus for any ARMSTRONG SUPER RECEIVER HOOK-UP. This includes the "Flivver," the "2-Tube" and the "3-Tube."

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COMBINATION FLAT AND BANK WOUND

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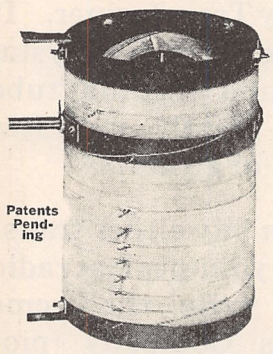

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Entirely Eliminates the use of **All Variometers, Variocouplers** and **Loading Coils**

Permits the building of the most compact and efficient receiver at a considerably lower cost.

Guaranteed Wave Length, 150 to 3000 Meters

We guarantee the "ALL WAVE" Coupler (with a money back guarantee) to give maximum results for long or short wave long distance *selective reception.* **List $9.00**

If your dealer cannot supply you, send us his name and your order with your remittance. We will supply you direct or through him.

WARNING: Don't permit unscrupulous dealers to urge you to buy something nearly as good for less money. Insist on the six hook-ups which accompany each genuine **"ALL WAVE"** Coupler and look for the trade mark on the Rotor.

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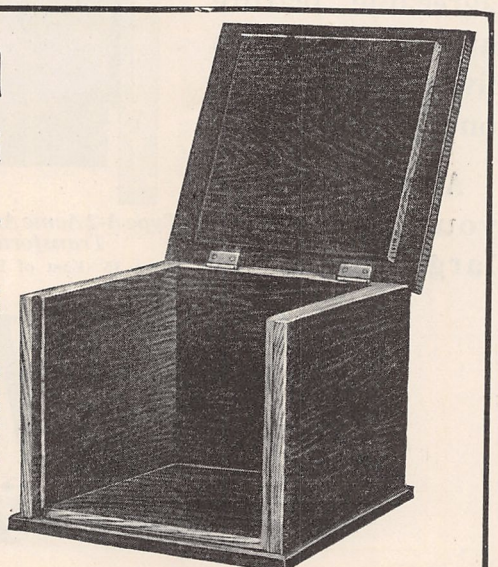
Prices—Postpaid in U. S., Delivery guaranteed. Cash with order. Panels not included in price.

Panel size	Inside dimensions High	Wide	Deep	Price
6x 7″	5½″	6½″	7″	$1.50
6x10½″	5½″	10″	7″	1.70
6x14″	5½″	13½″	7″	1.95
7x18″	6½″	17½″	10″	2.20
9x14″	8½″	13½″	10″	2.70
12x14″	11½″	13½″	10″	2.95



The Southern Toy Company
HICKORY, N. C.

of the set within six month. The original submarine set developed and built by a commercial concern required two and a half years, it is said, or five times as long. When all the subs are equipped, naval experts believe that these craft of the American Navy will be just a bit better equipped than those of any other navy in the world.

Very few details of the new sets are revealed, but it is known that they are vacuum-tube sets developed along original American lines. Late in the war, German submarines lying on the surface succeeded in sending messages during the night as far as 800 or 1,000 miles to their bases by using short wave-lengths of about 300 meters. Spark sets were used until the last few months of the war, when vacuum tubes were introduced in sending, although they had been used in receiving for about a year. The German spark was operated on a 500-cycle frequency about 2-k.w. capacity. Much of their equipment they considered very confidential and after an unsuccessful engagement they threw the important parts overboard or into the bilges. Although arc transmitting sets are said to be dangerous for submarine use on account of the gases given off by the many electrical storage batteries, 2-k.w. arc sets were used in British subs successfully. In American submarine practice a grounded loop is used. This aerial is very efficient and consists of a highly insulated wire grounded at the extremities of the hull and running to a mast amidships. Two down leads of the loop pass through watertight insulators into the hull, where the primary of the circuit is connected in series. The loop is connected with the standard naval radio equipment by the ordinary means, except that a condenser in series is used when transmitting.

Owing to the ability of the undersea craft to submerge with the aerial in place, it is possible to receive long-wave signals under water to a depth of about 20′, and short-wave signals to a lesser depth. In 1919, a submarine 16′ under water off New York picked up signals sent out from Arlington, 200 miles away, and while submerged at 8′, heard Nauen, Germany, 4,000 miles distant, and also San Diego.

On underwater transmission little is available for publication, but it is understood that transmission as well as reception is practical.

The aid radio brings is interesting: Recently the S. S. *Wassaic,* whose call is KROO, experienced boiler trouble about 350 miles southeast of New York. Her SOS was answered by KEFT, *The City of Eureka,* another Shipping Board vessel, which towed her into New York safely. When WDOO, the S. S. *Federal,* stripped her turbines and sent out a distress call 200 miles northeast of the Bahamas, the *City of Weatherford* soon hove alongside and arranged to tow the disabled *Federal* to Mobile. Another Shipping Board vessel was towed from off St. Nazaire, France, over 2,000 miles to an American port in response to a radio message to sister ships bound west—thus saving tremendous salvage payment. Without radio she might have awaited assistance for months.

Lack of radio facilities shows its value best, perhaps: When the *Western Hero's* radio got out of order on one cruise, she was literally "lost" for two weeks, but "found" when it was repaired. A cargo ship whose radio officer died, sailed without waiting his replacement, and, in endeavoring to pursue the northern trans-Atlantic route without radio, ran into icebergs and damaged herself to the extent of about $10,000—she could not pick up the Naval Hydrographic Office warnings nor the messages of the revenue cutter on ice patrol.

Today the activities of the Shipping Board are less than a year or two ago, there being only about 400 vessels in commission. Radio maintenance on the many laid-up ships has been reduced materially and a saving of

approximately $130,000 achieved, by the assumption of the upkeep by the Board and the elimination of repair shops maintained by outside radio contractors in seven ports. For radio messages transmitted the Board collected about $30,000 during the past year.

Business is expedited greatly by the operation of a special radio station established at London, which, in co-operation with the Naval Communications Service, handled all trans-Atlantic radio messages for London officials direct from Annapolis. Frequently, messages filed in Washington at the close of business on one day are answered by the time the Washington office opens on the next. The London radio supervisor estimates that a saving of over $11,000 a year is effected by using radio for trans-Atlantic dispatches. Radio messages to Panama, Manila and the Orient are also handled through naval co-operation, saving almost $5,000 per annum over cable charges.

In technical development, the Shipping Board has experimented with a 2-k.w. arc set, installed on the S. S. *President Adams,* which succeeded in communicating with American stations while the vessel was in the English Channel. The operation of this set is said to be almost entirely automatic, being a new departure in the construction of sets. The S. S. *Eastern Admiral* and *President Polk* were also equipped with 2-k.w. Federal arc sets with good results after a direct comparison with spark sets.

Radio Protects Sea Travelers

By CARL. H. BUTMAN

Due almost entirely to the use of radio on the Shipping Board's fleet, not a single ship has been lost without trace during the past three years, according to F. P. Guthrie, head of the Radio Section. Whatever hard knocks the Board may receive, little can be said against its radio equipment and its operation. Practically all Shipping Board vessels are now equipped with audion-tube detectors, which have also been made available for general marine use through the insistence of the Board, making for greater safety in sea travel. Ships, lives and money have been saved, and in general radio has a fine record in all the government services.

These days we seldom hear of mysterious losses at sea—ships which disappear or return crewless, as did the *Marie Celeste*—due chiefly to radio, the safeguard enabling ships to converse together freely and communicate with one port or another every day. The naval collier *Cyclops* is practically the only "missing" vessel recorded since the advent of the radio law at sea in 1912, except during the war.

The Coast Guard, Navy and Bureau of Navigation of the Department of Commerce all indorse radio highly, yet no bureau keeps a record of what radio actually does toward life and property saving at sea. Lost ships are recorded to the number of 380 from all causes for the year 1921, but the number saved, thanks to the SOS, is undetermined. A year ago the Shipping Board reported that approximately 500 vessels in distress or temporarily disabled were reported by radio, and that about 190 were towed to port through arrangement made by radio. This assistance rendered by the radio of Shipping Board vessels, augmented by other radio warnings in all parts of the world, protected hundreds of thousands of lives and billions of dollars' worth of property—but no adequate estimate can be reached.

The National Co-operative Radio Society

By ROY A. ANDERSON

The National Co-operative Radio Society is the name to be given to a national society which is now being formed. The purpose of this society is,

Burgess, the Radio Battery
—construction fully patented

When you buy a Burgess "B" Battery you get more than long life, noiselessness, high capacity and moderate price. You get also Burgess special radio construction, perfected by wireless specialists and fully patented! This exclusive *radio* construction is found in no other battery on the market today.

What does this mean to users of radio batteries? It means clear receiving. It means lowest cost per hour of service. It means long shelf life and highest current capacity. It means that Burgess "B" Batteries are the best radio batteries it is possible to produce. Don't take our word for it—*ask any radio engineer.*

Leading manufacturers of radio equipment specify "Burgess." Burgess "B" Batteries are handled by all progressive jobbers and dealers. "Look for the Black and White Stripes." And if your dealer doesn't handle Burgess "B" just address:

BURGESS BATTERY COMPANY
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NEW YORK, N. Y., 50 Church St. MADISON, WIS., Main and Brearly Sts.
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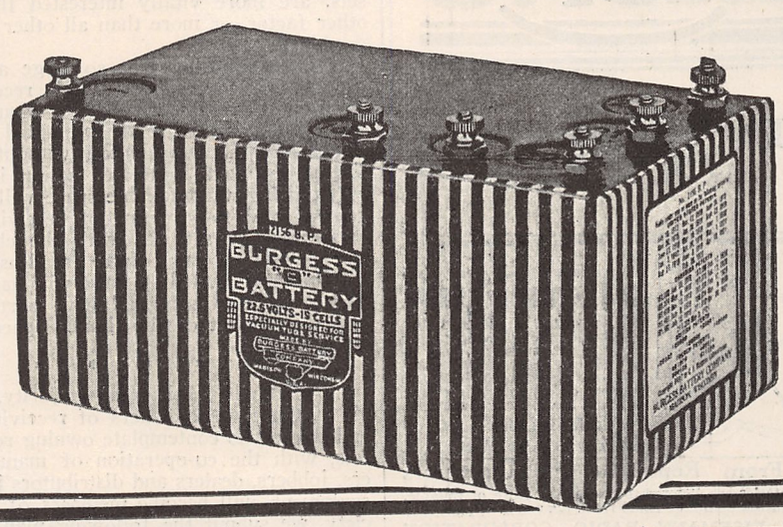

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Recharged at Home in 1 Minute

Simply unscrew cover and insert "spare" charged electrode. "Spares" are exchangeable at your dealer's or from us at 25 cents each.

No Charging Equipment Needed

"Spare" charges can be kept indefinitely. They will not "run down" prior to insertion in the battery. They need no more care than a hammer. By keeping "spares" on hand your concert will never be interrupted.

Each Magno Battery is a 2-volt unit. Two in series is sufficient for the new 4-volt tubes. Three in series for the 6-volt tubes. Each positive electrode is rated at 30 ampere hours, but because of their unusual recuperative power they last much longer than their rated capacity.

You can get a greater ampere hour capacity with Magno batteries and a few "spares" per dollar invested than from any other battery.

Write for descriptive folder R1.

Price per battery $6.00
Price per positive electrodes.. 1.00
Positive electrodes exchanged. .25

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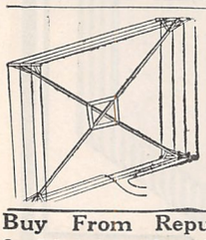

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INDOOR COIL AERIAL

Drawing, R. F. amplifier circuit, chart and tables giving proper number of turns to put on coil for any wave length. Complete data covering 0 to 24,000 meters on three large sheets, $1.00. Stamps not accepted.

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2371 Champlain St., Wash., D. C.

Buy From Reputable Manufacturers

Our 3 factories are devoted to the manufacture of reliable, guaranteed complete radio receiving sets and parts.

FREED EISEMANN RADIO CORPORATION
255 FOURTH AVENUE NEW YORK, N. Y.

generally speaking, for the betterment of the radio broadcasting entertainments.

Everyone can see that the present grade of broadcasted entertainment is not at the high standard where it really belongs, and with individual ownership it is practically impossible, or at least improbable, that there will ever be anything much better.

With the definite purpose of betterment in mind, the plan for this national society was made. The idea is this: Everyone who owns or contemplates owning a receiving set should join; he should believe it his conscientious duty to belong and to pay his yearly dues, from the total of which radio broadcasting stations will be purchased or leased by the society and with which artists (artists, you understand) will be paid for the programs which they will give in New York, we'll say, and which will then be directly relayed, from receiving set to transmitter, by all of the broadcasting stations owned by the society. By this plan there is but one program, and everyone can hear it.

The society states that its dues are not to exceed $12 a year, which is really only $1 every month, and the artists of the world can be brought to your home every day in the year, for three and a third cents a day! A 12-hour daily program is planned, too.

In this booklet the society says many things of interest, and extracts are here given which will not only give the reader a better idea of what the society stands for, but will show him the need for action on his part, for the benefit in such a society is not to be denied:

* * * * *

Regulations by the government of broadcasting activities in the air are being formulated. The "White Bill," drawn to regulate radio, is intended to give Secretary Hoover authority to promulgate such rules and regulations as are found necessary In the meantime, the erection of new broadcasting stations, or the completion of those in process of construction, is prohibited until permission is granted by the Secretary of Commerce.

This indicates that radio telephony, particularly as related to broadcasting, has reached a crisis. Hence, it behooves all friends of radio telephony to give a thought to the future, and as a result of such thought formulate a definite, specific and practicable plan, and having adopted such a plan, put united effort behind it, so that this latest and greatest development of science and art may become of permanent and lasting service to the greatest number.

Inasmuch as there are now no less than 600,000 owners of radio receiving sets in the United States, with a possibility of several million, under favorable conditions, unquestionably the owners of receiving sets, and those who contemplate owning receiving sets, are more vitally interested than any other factor, or more than all other factors combined.

It is unthinkable that so large a factor should fail to receive proper recognition from our Government. * * * Our claims for recognition must be presented to the commission at Washington without delay, for, unless some concerted action is taken very quickly, the available space will be exhausted and the owners of receiving sets must then be satisfied with the character and quality of such free broadcasting as may be promulgated by those who have realized the opportunity and have participated in the allotment of the limited space available.

* * * * *

Upon the basis that the majority, if not all of the present owners of receiving sets, and those who contemplate owning receiving sets, with the co-operation of manufacturers, jobbers, dealers and distributors in radio equipment, will become members of the society, we submit the following plan:

That an organization be perfected as quickly as possible, the name of which shall be "The National Co-operative Radio Society," it being understood that this National Society is created for the purpose of financial gain.

Membership: Membership, or memberships, are available:

1. To any individual or firm interested in the welfare of radio telephony.

2. To any individual or firm owning a receiving set, or who may contemplate owning a receiving set.

3. To any corporation, manufacturer, distributor, jobber or dealer in radio apparatus or complete receiving sets, or kindred lines. (These are urged to take as many memberships as may be warranted by the pecuniary benefits to accrue from increased sales, due to de luxe program properly broadcasted by the National Society.)

4. To any radio engineer, or other individual holding certificate or permission to broadcast or receive.

5. Honorary memberships may be extended when considered advisable by the National Committee on Memberships.

Objects: The objects of the National Society are to effect a national community of interest among parties who are now interested or may hereafter become interested in radio telephony.

Broadcasting: The National Society will build, own or lease and operate a chain of broadcasting stations. Where broadcasting stations are already in existence suitable for the purposes of the National Society, they may acquire same by lease, purchase, or otherwise. Additional equipment for broadcasting is to be added from time to time, as the progress of the art of broadcasting may demand, to the end that a permanent, satisfactory and up-to-date broadcasting service may be maintained.

Zones: The United States will be divided into zones. * * * Thus the program broadcasted, when relayed from station to station, will be available to all members located in each respective zone. The broadcasting stations will have sufficient power to cover a radius of 1,000 miles or more under favorable conditions. However, the broadcasting stations will be located approximately 500 miles from each other, so that satisfactory service may be rendered, even under unfavorable conditions. Amplification and auxiliary equipment will be used, if necessary.

Program: Program promulgated will begin at ten o'clock in the morning and be continuous until ten o'clock P. M.

The services of paid artists, entertainers and other talent (all to be of importance in their various walks of life) are to be paid for out of the funds of the National Society.

Local Chapters: A district chapter will be located in each zone and in all cities and towns contiguous thereto, the chapters to be operated under the supervision and instruction of the National Society.

Finances: It will be seen from the above that the primary objects of the National Society are to establish its own broadcasting stations, and to promulgate a daily de luxe paid program, and for this purpose and such other purposes as may be decided upon, the National Society will assess its members not more than twelve dollars ($12) per year for each membership, payable annually, quarterly or monthly, as may be most convenient to the member. The moneys so received are to be disbursed as follows:

Building or leasing, or otherwise acquiring broadcasting stations.

Overhead entailed in operating and upkeep of broadcasting stations.

Remuneration to paid artists, professionals and other talent, employed by the National Society to take part in their daily program.

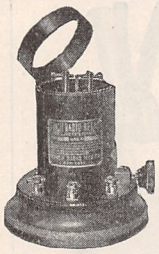
Such other expenses as may be necessary for the maintenance of the National Society.

Organization Expenses: For the purpose of defraying the expense of organization, it is required that each application for mem-

FINCH RADIO PRODUCTS GIVE MAXIMUM SERVICE

Not like the rest
They are the best
---the very best.

Get More Fun Out of Your Radio—Read the Fastest Code Messages at Your Leisure



Finch Radio Relay.$75.00
Std. Tape Register. 55.00
Telegraph Relay... 7.00
Paper Tape, per roll .10
Register Ink, 2-oz. bot. ..... .50
Register Ink, pt. bot. 2.00
Prices of Other auxiliaries on request

EVERY hour of the day the air is full of telegraphic signals telling of the important news events. Countless government and commercial messages are being exchanged between our country and foreign capitals. Are you listening in on these world events or are you a "radio wall-flower" because you cannot read the code fast enough? The things broadcasted by code are oftentimes more interesting than those transmitted from the broadcasting stations. By equipping your station with an amazing yet simple device,

THE FINCH RADIO RELAY

(Patented and Patents Pending)

you can automatically receive and at the same time have a permanent record of any desired message whether or not you know the code. And you do not have to be present at the instruments to get any message you want.

The Finch Radio Relay **traps the message on a paper tape**—makes a **permanent record** of it; in short, if you know what an ordinary ticker does, you know how the Finch Radio Relay works.

Tremendously sensitive, rugged fool-proof, this remarkable instrument is easily adjusted to any vacuum tube receiver.

OTHER THINGS YOU CAN DO BY RADIO WITH THE FINCH RELAY

1.—Automatically Receive and Record.
2.—Operate a Telegraph Sounder.
3.—Ring a Bell.
4.—Ignite Explosives by Radio.
5.—Control a Moving Vehicle.
6.—Visible Indication.
7.—Radio Burglar Alarm.
8.—Simultaneously Record and Re-Transmit Messages.

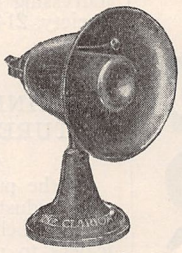
Tested by the New York "Evening Mail" Radio Institute, approved and awarded Certificate of Excellence.

THE CLARION

"Like the Human Voice"

THE Clarion is one of the most faithful reproducers of the human voice and music that has ever been perfected. It has a soft, mellow tone that is absolutely free from those metallic sounds that are so objectionable to those who enjoy good music. And there is no distortion with the Clarion. Its many patented features fix that. Note the volume regulator which will allow you to regulate the sound like you do with your phonograph. The tone modulator also allows you to adjust the tone of the instrument.

The Clarion comes finished in polished nickel or statuary bronze. A truly beautiful instrument that will harmonize with the very best receivers. Price. **$15.00**



Patented

GREATEST EVENT IN RADIO

FOR ONE MONTH ONLY

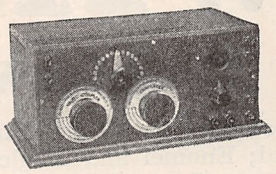
V.T.2—Excellent Amplifier and Power Tube $8.50
V.T.1 or J Tube—Excellent Detector and Amplifier..... 7.50
These tubes are not rejects and are guaranteed by us.

Tested by the New York "Evening Mail" Radio Institute, approved and awarded Certificate of Excellence.

THE FINCH VACUUM TUBE RECEIVER

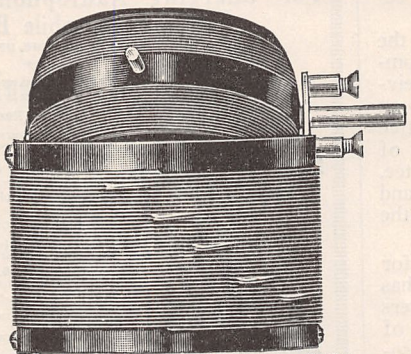
Designed and Built by Men Who Know Radio

THE Finch single tube vacuum receiver is a model instrument in every respect. It has three tuning controls, which insure great selectivity and freedom from interference. All of the parts are mounted on a pure bakelite panel. The cabinet, which is beautifully finished, is of hard wood, and measures 6½ inches high, 7½ inches deep and 18⅞ inches long. The hinged top allows the user to make interior adjustments with ease. Rubber covered binding posts used throughout. This is a receiver that you will be proud to own and operate. Detector and tuning unit complete except vacuum tube, phones and batteries. **$44.50**

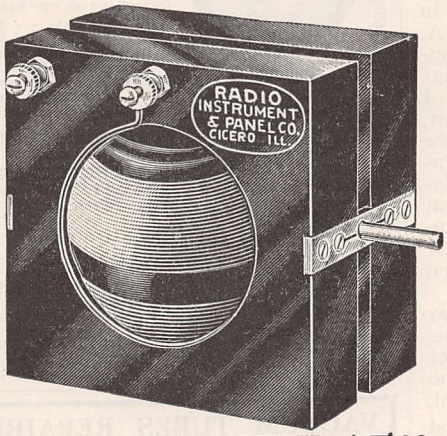


Dealers and Jobbers—Write for our interesting sales plan. Other Literature sent on receipt of stamp.

FINCH RADIO MFG. CO., 303 Fifth Ave., New York, N. Y.



MOULDED COUPLER $4.50=
¼" SHAFT



MAHOGANY VARIOMETER $5.00=
¼" SHAFT

SPECIAL OFFER
2 COUPLERS
1 VARIOMETER $13.75=

Buy Now AND GET BEST PRICES AND SERVICE FROM AN ESTABLISHED HOUSE

GET THESE POINTS:

Bearings will not bind. All metal parts white nickeled. Rotor balls hard rubber and solid mahogany. Windings of green double cotton covered wire.

VARIOMETER

Binding posts have large knurled thumbnut. Minimum clearance between rotor and stator. Mounts easily and is designed for low dielectric losses and maximum range of induction. All mahogany finish, wonderful appearance. Effective tuning range of 150 to 650 meters.

COUPLER

Moulded hard rubber rotor ball. Primary windings on black polished fiber tube. Has nine taps for varied inductance. Easily installed. Will operate perfectly and give higest efficiency. Save money by using this cheaper and better equipment.

LOOK AT THESE BARGAINS

HARD RUBBER VARIOMETERS. Green cotton covered wire, all parts white nickeled, rotor ball and stator forms all hard rubber. A beautiful product that will give results. EACH $5.00=

3-plate Vernier Condenser.....$2.80
11-plate Variable Condenser, assembled without dial..... 3.20
23-plate Variable Condenser, assembled without dial..... 3.60
43-plate Variable Condenser, assembled without dial..... 4.00
All-American Radio Frequency Transformer 4.50
4-inch Moulded Dial, ¼-inch hole... .95
Audio Frequency Amplifying Transformers, ratio 3½ to 1..... 4.00
Audio Frequency Amplifying Transformers, ratio 9 to 1..... 4.50

Rheostats, Moulded Base.....$1.00
Vernier Rheostats 1.50
Potentiometers 1.50
1-piece Moulded Dials, 3/16 or ¼ inch hole, each ..... .75
Grid Condensers ..... .60
1-piece Moulded VT Socket, each..... .75
Bridging Condensers ..... .60
Galena Detector Crystals moulded in lead cups, each..... .20
Small Knob Indicating Switch, each.. .50
Large Knob Indicating Switch, each.. .50
Contact points with nuts, each..... .01½
Contact stops with nuts..... .01½
Binding Posts, Moulded Knob, each... .10

Detector Unit in a very neat appearing black case, compact and easy to carry.....$65.00
Amplifying Unit, two step, in a case that can be attached to detector unit..... 65.00
Detector and One Stage of Amplification, all in one case..... 105.00
Detector and Two Stages of Amplification, all in one case..... 140.00
Radio Frequency, sensitive to finest tuning and capable of long range..... 190.00

All above sets, except amplifying unit, include B battery, phones and tubes.

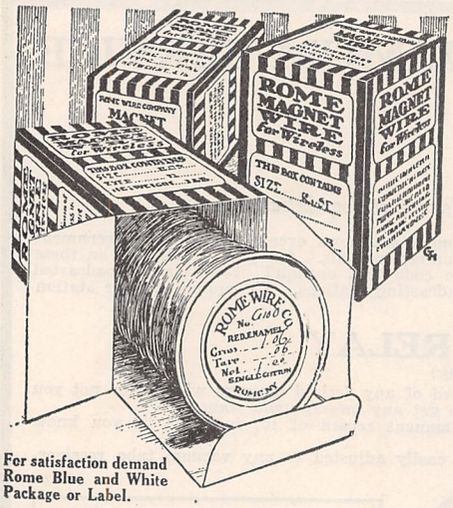
Shipped immediately from stock—order now.

We pay transportation charges. If you are not satisfied in every respect with our equipment return at once and we will refund your purchase price.

DEALERS: write for our proposition.

RADIO INSTRUMENT AND PANEL CO.

26 N. DESPLAINES ST., CHICAGO, ILL.



For satisfaction demand Rome Blue and White Package or Label.

ROME RADIO WIRE

Magnet Wire

Best Quality Plain Enamel Covered; Enamel and Single or Double Cotton Covered; Single or Double Cotton Covered.

All sizes: ¼- lb. to 40-lb. packages.

Antenna Wire

Best Quality Solid or Stranded Copper Antenna Wire, plain or tinned; put up in lengths of 100-ft. and 150 ft., or on 24″ reels of 200 lbs.

At Your Dealer's

ROME WIRE COMPANY
ROME, N.Y. . . . . BUFFALO, N.Y.

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LOS ANGELES . . . J. G. Pomeroy, 336 Arusa Street

CLINTON VACUUM TUBE RECEIVER

Everything complete in one unit.

No unsightly exterior batteries, etc.

THE ONLY ONE OF ITS KIND ON THE MARKET. MUST BE SEEN TO BE APPRECIATED

THE ONLY COMPLETE VACUUM TUBE SET ON THE MARKET

The "CLINTON" Vacuum Receiver complete with Vacuum Tube, Batteries, 2000 ohms headsets, aerial wire, insulator and ground wire, only $50.00. Everything complete; all you have to do is install it, following the simple directions, and you are ready to receive messages from the air.

CLINTON RADIOPHONE CO.
29 S. Clinton St., Dept. X. Chicago, Ill.

bership, or memberships, be accompanied by a fee of one dollar ($1) (for each membership); this to be applied to the expense of organizing the National Society.

Officers, Etc.: A President, Vice-President, Secretary and Treasurer will be elected as soon as charter for the National Society is granted (charter has been applied for). Committees and subcommittees will be appointed by the President, so that the business of the National Society may be properly administered.

Bonds: The Treasurer of the National Society, Trustees or other parties who may handle the property or funds of the society will be bonded in sufficient amount to protect the financial interests of the National Society.

Now you ought to know what and why the National Society is. Further particulars and application blanks may be secured by addressing the National Co-operative Radio Society, 214 Saratoga St., New Orleans, La.

PROMINENT RADIO MANUFACTURERS FORM NATIONAL ORGANIZATION

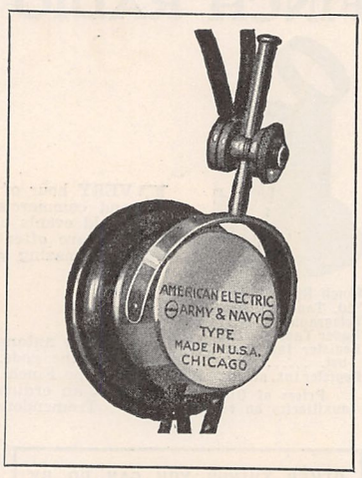
As the public interest which supports the radio industry is dependent upon broadcasting, it behooves the manufacturers and dealers to unite in some definite action regarding this situation. Moreover there are certain questionable practices that can best be corrected by forming an association of radio manufacturers. Therefore the Radio Apparatus Section of the Associated Manufacturers of Electrical Supplies was organized in New York City to place the radio industry upon a sound basis, to study the public taste in the matter of broadcasting programs, and to support and promote broadcasting stations, to promote the standardization of radio apparatus, to advance and protect the interests of the manufacturers of radio apparatus, to collect and disseminate information, and to promote cooperation among the members.

Committees have been formed to fulfill the purposes indicated by their names: Committee on Publicity, Committee on Receiving Sets and Equipment, Committee on Aural Devices and Accessories, Committee on Standards, Committee on Support of Broadcasting, and the Executive Committee, which is composed of the chairman and treasurer of the Radio Section, and of the chairmen of the standing committees.

In order to provide financial support for broadcasting, the expense of which has hitherto been borne by the manufacturers who send out the programs, the members of the Radio Apparatus Section of the Associated Manufacturers of Electrical Supplies will be taxed for an amount depending upon the annual gross sales of each member. In return for this, members of the R. A. S. A. M. E. S. will be entitled to affix to their apparatus and include in their advertisements the insignia of the association, by means of which the public will be made cognizant of, and be led to show their preference for, the manufacturers who are supporting the entertainments which they enjoy. This insignia is but part of a broad plan of general publicity which is designed by the Committee on Publicity to acquaint the public at large with broadcasting programs and broadcasting policies.

Moreover, Governmental legislation may more readily be watched and opposed by this organization, and results should be better than those attained by manufacturers who fought restrictive legislation single-handed.

Profiting by the experience of electrical and automobile manufacturers, as well as manufacturers of engineering products in general, the Radio Apparatus Section of the Associated Manufacturers of Electrical Supplies has undertaken, through the Committee on Standards, the consideration of recommendations that ought to be followed



American Electric

HIGH GRADE

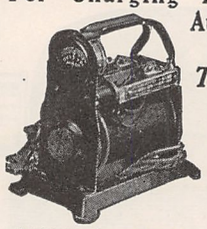
HEAD SETS

Army and Navy Type:
2500 OHM, PER PAIR, $10.00
3200 OHM, PER PAIR, 12.00

Swedish-American Type:
2200 OHM, PER PAIR, . 8.00

American Electric COMPANY
CHICAGO

For Charging Radiophone and Automobile Batteries at home, use



The Sterling Portable Rectifier

It is not necessary to lug your battery to a service station. Rectifier charges your battery without its being disconnected from Radio outfit.

Mechanism simple, effective and durable.

One thumbscrew does all adjusting. Either clip can be attached to positive terminal. No danger of injuring battery.

Initial charging rate 6 volt battery either 5 or 10 amps.

Price complete, **$16.00.** (West of Rocky Mountains) **$17.00.**

We Also Manufacture

Radio Frequency Transformers - - - - - - **$4.00**
Audio Frequency Transformers - - - - - - **$6.00**
Filament Rheostats - - **$1.25**
Filament D. C. Ammeters and Voltmeters - - - **$4.00**

Sterling Pocket Voltmeters for testing Type "B" Batteries
34-B (O-30 Volts) - - - **$2.25**
34-C (O-50 Volts) - - - **$2.75**

Write for Booklet Giving Full Information

THE STERLING MANUFACTURING COMPANY
2831 Prospect Avenue Cleveland, O.
Over two and one-half million Sterling Electrical Devices in use today

THE AMATEUR RADIO "MICROCOUPLER" IS MOST EFFICIENT BECAUSE IT: (Patent Applied For)
Has combined coarse and vernier adjustments.
Has no metal parts throughout.
Has no compounds between turns.
Permits closer maximum coupling.
Permits shortest possible grid connection.
Is excellent for DX, CW and PHONE work.
The coupler that brings in WSB and other long-distance phones and amateurs every night (since June) through all sorts of weather, on a small antenna. Special introductory price: For panel mounting, 8 taps, 150-450 meter range, $3.60. Unit Panel Complete, $7.75, postpaid.
AMATEUR RADIO EQUIPMENT SUPPLY, 1504 FEDERAL ST., PHILADELPHIA, PENNA. Limited First Stock.

VACUUM TUBES REPAIRED

ALL MAKES DETECTORS AND AMPLIFIERS REPAIRED EQUAL TO NEW

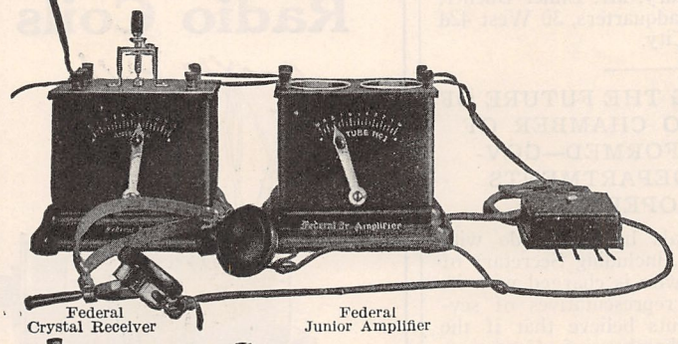
Detectors, $3.00 — Amplifiers, $3.50

Work is guaranteed satisfactory. We have a competent organization.

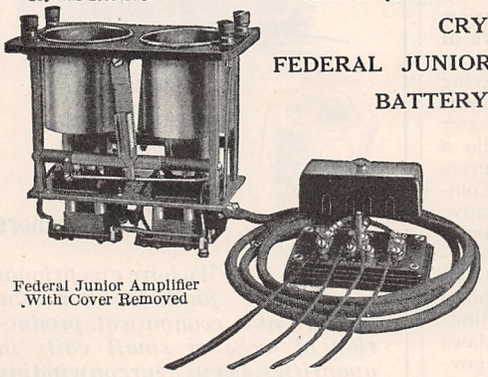
Interesting Proposition to Agents

CURTISS RADIO COMPANY
126 South 8th Street Newark, N. J.

Federal



Federal Crystal Receiver — Federal Junior Amplifier



Federal Junior Amplifier With Cover Removed

RADIO PRODUCTS

ARE UNIVERSALLY KNOWN AND ACCEPTED AS

THE STANDARD

FOR EFFICIENCY, DURABILITY AND DESIGN

WE MANUFACTURE A

COMPLETE LINE

INCLUDING

CRYSTAL RECEIVING SETS,
FEDERAL JUNIOR and SENIOR AMPLIFYING UNITS,
BATTERY UNITS, TERMINAL BLOCKS,

HEAD TELEPHONES

Microphones, Transformers, Jacks, Plugs, Condensers, V. T. Sockets, Rheostats, Anti-Capacity Switches, Etc.

Demand Genuine ***FEDERAL*** *Radio Products FROM YOUR DEALER and secure the best results*

Federal Head Telephones

Federal Telephone & Telegraph Co.

BUFFALO, NEW YORK

PERFECTO-VOX

(PERFECT VOICE)

Announcing
The Radio Frequency Receiver

This receiver has three stages of radio frequency amplification—detector, the new Western Electric power amplifier and loud speaker, with tubes mounted in one cabinet.

Receiver is so constructed that loop or outside antenna may be used. Loop is connected to cabinet by means of telephone jack.

When used with a loop, all the large broadcasting stations can be heard, and interference is reduced to a minimum by the use of the new movable iron cores in the radio frequency transformers.

Ready for delivery Oct. 20.

Dealers and jobbers write now for prices and territory.

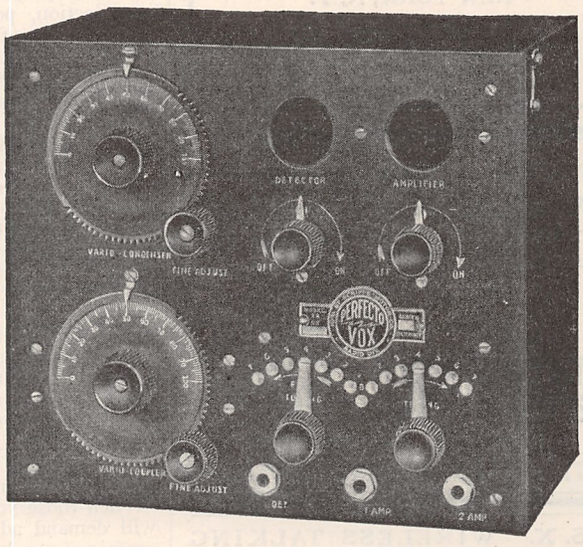
THE SCRIPPS MOTOR CO.
RADIO DIVISION
DETROIT, MICHIGAN

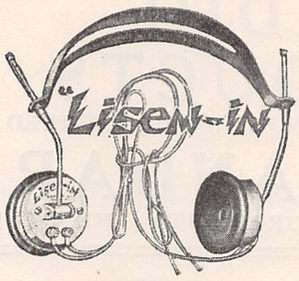
All the name implies. The lowest priced high-grade receiver now on the market.

This receiver is complete with detector—two step amplifier—vernier control dials—filament control jacks. Sold on a money back guarantee.

Order thru your dealer or write direct.

Price, $90.

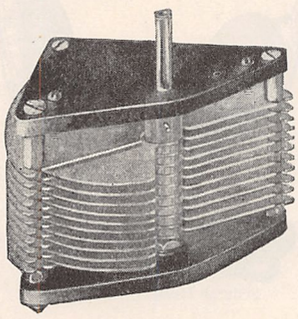




Headphones

A two pole, 3000 ohm phone that combines clearness with comfort—strength without being cumbersome — and is equally well adapted for use with either crystal or audion bulb sets.

List price.....$7.50



Variable Condensers

The finest design, materials and workmanship mark the LISEN-IN Variable Condensers as "Instruments of Precision." Made in two sizes, listing at:

23 plate.....$2.50
43 plate..... 3.50

All LISEN-IN products are guaranteed as represented and will give entire satisfaction or your money back without question.

At your dealer or jobber or direct from the manufacturer.

NATIONAL RADIO COMPANY

50 Union Square

NEW YORK, N. Y.

Live Wire Distributors Write for Our Interesting Proposition

FROM CAT WHISKERS UP—

We can supply everything that's best in Radio, 1 or 101 of any article to user or dealer. Same day shipments.

Inquiries are welcome

UNITED ELECTRIC STORES CO
106 ELECTRIC AVE. EAST PITTSBURGH, PA.
721 BRADDOCK AVE. BRADDOCK, PA.

DISTRIBUTORS
Wholesale & Retail
Westinghouse
Brandes Federal
Murdock, DeForest
Radio Corporation
and many others

AT EAST PITTSBURGH, PA.—NEXT DOOR TO KDKA

"E. S. X." WIRELESS TALKING MACHINE ATTACHMENT

SILVER $3.00 GOLD $4.00

ESSEX WIRELESS SPECIALTY COMPANY
31 NEW STREET NEWARK, N. J.

by manufacturers. These recommendations will be announced when the time is ripe.

Manufacturers desiring further information regarding the Radio Apparatus Section of the Associated Manufacturers of Electrical Supplies may address their communications to the Secretary, Mr. Elmer Bucher, at the association headquarters, 30 West 42d Street, New York City.

SAFEGUARDING THE FUTURE OF RADIO—RADIO CHAMBER OF COMMERCE FORMED—GOVERNMENT DEPARTMENTS TO CO-OPERATE

Government officials having to do with radio communication, including Secretary of Commerce Hoover, who is charged with its regulation, and the representatives of several other departments believe that if the newly organized Chamber of Commerce lives up to its plans and aims, the future of radio in this country is assured.

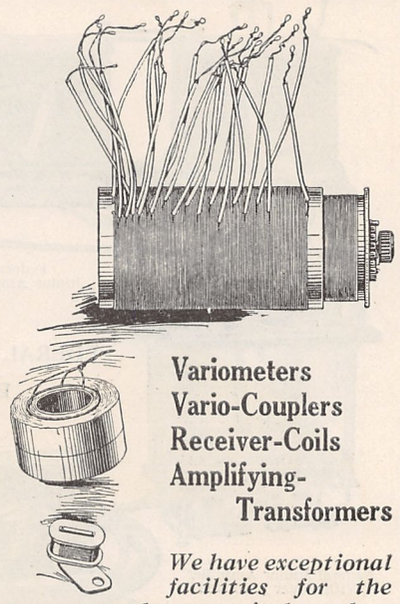
Based on sound principles of guaranteeing to the users of radio, and the public in general, standard and efficient radio sets, better broadcasting and aiming to make radio a public utility, the pioneer manufacturers formed the first Radio Chamber of Commerce last week. It was a representative meeting, there being over thirty radio manufacturing firms from all parts of the country present, said to represent over 80 per cent of the manufacturers. The possibility of "clique or sectional" control was eliminated by the constitution and by-laws adopted. The election of a board of governors, including eleven district vice-presidents, each of whom has a vote, guaranteed that each of the nine radio districts would have at least one representative on the governing board.

At the opening of the three-day session at the Wardman Park Hotel, Judge W. H. Davis of New York was made temporary chairman. In the absence of Secretary of Commerce Hoover, detained by coal conferences, the chairman presented a message approving of the formation of the national chamber from the Secretary, and carrying a promise of co-operation if the plans of the chamber to "maintain a high standard of quality and dependability in the manufacturing of radio apparatus" and to protect the public from inferior sets made by manufacturers who do not have the welfare of the industry under consideration, were carried out.

A committee of fifteen manufacturers was nominated representing the radio industry for officers and directors of the chamber.

During the first day's sessions Commander S. C. Hooper, of the Naval Radio Engineering Section, pointed out the value of an organization of reputable manufacturers to the country as an asset to national defense and urged the co-operation of manufacturers with governmental radio apparatus specifications. "The Navy Department," he said, "has practically made the present state of radio communication possible by its specifications of a standard vacuum tube and other devices." Standardization was one of the most important needs of the present industry, he stated, explaining that we could not afford to have lamps made by one firm which did not fit into sockets made by another. "Due to the inability of the radio manufacturers to cope with the tremendous demand for apparatus which swept the country recently," Commander Hooper pointed out, "practically a million men and boys have been forced to build their own sets, with the result that they know a lot about radio, as much perhaps as if they had taken an ordinary B. S. college course. "When those young men get to college they will demand advanced radio work, thus increasing our knowledge in radio development, besides being a potential asset in the number of operators in the event of wartime needs." Capt. Guy Hill, of the Army

Belden
Radio Coils



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We have exceptional facilities for the prompt and economical production of large or small coils in quantities. Let us figure on winding in accordance with your designs.

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Eastern Office and Warehouse, Metuchen, N. J.

BOYS! A REAL RADIO SET ABSOLUTELY FREE

RUSH your name and address and we will tell you HOW you can get this RADIO SET ABSOLUTELY FREE. RADIO SET comes to you complete, with single slide tuning coil, crystal detector and phone condenser, AND DOUBLE HEAD PHONES. No batteries required; no experience. Write Today for Free Radio Plan.

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Licensed Armstrong U. S. Pat. 1,113,149

The never-ending pleasure derived from radio is assured in TRESCO UNIVERSAL. The most discriminating amateurs in all parts of the world have been using Tresco receiving sets for the past seven years.

Today you benefit from these seven years' experience, and, in Tresco, purchase a receiving set that gives you even more than you expect.

Ask your dealer; if he cannot supply, write us.

TRESCO RADIO
J. Fatheree Bell Sales Rep.
Davenport, Iowa, U.S.A.

RADIO INVENTIONS WANTED

Useful radio inventions will be purchased by large manufacturer, either before or after filing patent. And their own patent attorney and expert will aid wireless experimenters and inventors to patent and commercialize their ideas. Write fully what you have, sending sketches and description. All correspondence held strictly confidental.

Address: P. O. BOX 291, GRAND CENTRAL, NEW YORK CITY

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ELECTRIC APPLIANCES

Radio Apparatus with that "BUILT-IN QUALITY"

"Designed Then Built"

Every part made in our own factory, backed by years of experience in the Radio and Electrical Industry, carefully tested and packed in individual cartons

MECHANICALLY PERFECT
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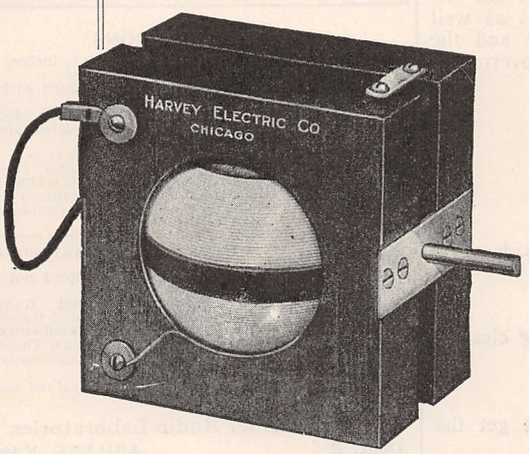


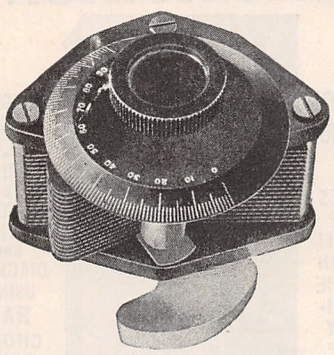
VARIOMETERS *VARIOCOUPLERS*

VARIABLE CONDENSERS

TWO-STEP AMPLIFIERS

EMPIRE TRANSFORMER DIVISION
HARVEY ELECTRIC COMPANY
2000 Southport Avenue CHICAGO, ILL.

Chelsea Variable Condensers (Die-Cast Type)

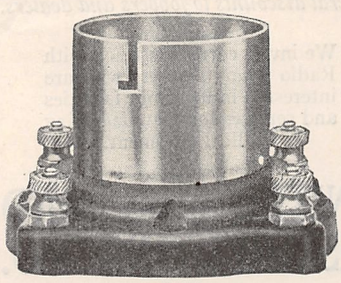


No. 3, Price $4.75

No. 1—.0011 m.f. mounted	$5.00
No. 2—.0006 m.f. mounted	4.50
No. 3—.0011 m.f. unmounted	4.75
No. 3—.0011 m.f. unmounted, without dial	4.35
No. 4—.0006 m.f. unmounted	4.25
No. 4—.0006 m.f. unmounted, without dial	3.85

Top, bottom and knob are genuine bakelite, shaft of steel running in bronze bearings, adjustable tension on movable plates, large bakelite dial reading in hundredths, high capacity, amply separated and accurately spaced plates. Unmounted types will fit any panel and are equipped with counterweight.

Guaranteed for circuits up to 1,000 volts.

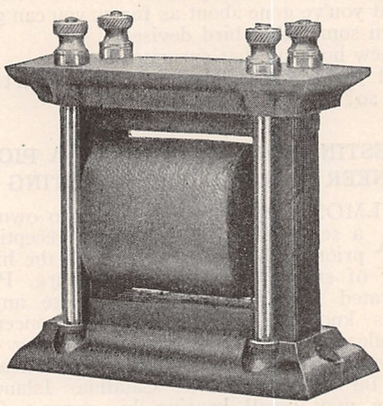


Price $1.00

Amplifying Transformer No. 50

The Chelsea Amplifying Transformer gives the highest amplification possible and at the same time will not squeal, howl, or in any way cause noisy circuits. It is beautiful in design and embodies electrical characteristics unequalled by any. Guaranteed for all circuits up to 500 volts with a high safety factor.

It will not fail in service.



Price $4.50

Bakelite Socket No. 60

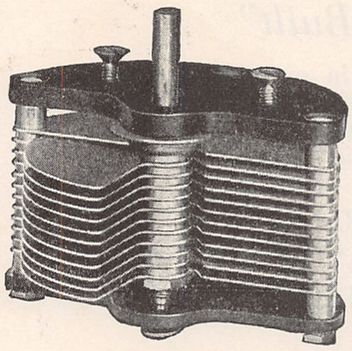
This socket includes a bakelite base supporting four external readily accessible binding posts. The tube receptacle is highly polished nickel and will take any standard detector or amplifying tube as well as the smaller size power tubes. Although primarily intended for receiving circuits, it will operate satisfactory on any circuit up to 1,000 volts. It may be mounted either on table or panel. Positive contact springs. An added beauty to any radio station.

Purchase Chelsea Radio Equipment from your dealer. If he does not carry it send to us. Write for our new No. 6 catalog.

Chelsea Radio Co., 150 Fifth Street, Chelsea, Mass.

Manufacturers of Radio Apparatus and Moulders of Bakelite and Condensite.

Variable Condensers



Variable Condensers to be efficient must be well made. Loose joints or faulty construction soon allows the plates to get out of alignment and decrease their efficiency.

A seasoned organization backed by a half million dollar equipment has placed the United Condensers in the front rank with radio engineers the country over.

Prices - 43 plate, $4.50
23 " 4.30
11 " 4.00
without dial or knob

Liberal discounts to jobbers and dealers.

We invite correspondence with Radio Manufacturers who are interested in using our facilities and services for manufacturing Radio Equipment.

UNITED MFG. AND DISTRIBUTING CO.
536 Lake Shore Drive
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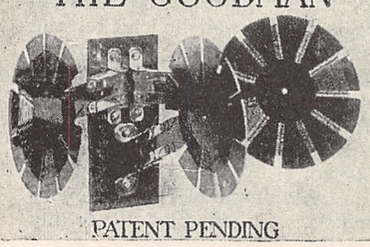
THE GOODMAN



PATENT PENDING

The niftiest short-wave tuner on the market

$6.00 and P. P. on one pound

Send for pamphlet. Order through your dealer.

L. W. GOODMAN
Manufacturer
Drexel Hill, Pa.

Signal Corps, and Dr. L. duP. Clement also spoke on the future of radio development, regulation and standardization.

A trip to the Washington Navy Yard was made by the delegates of the first day. On the second day the constitution and by-laws were adopted and Commander Hooper took a number of the visitors through the big Arlington Station. In the evening all the delegates and a number of Government officials attended a banquet, where Dr. S. W. Stratton, director of the Bureau of Standards, made an address, as did Dr. Louis Cohen, engineer of the Signal Corps, representatives of the Department of Commerce and Shipping Board Radio Section, and others. On Friday the manufacturers were the guests of Dr. Stratton and Dr. Dellinger at the Bureau of Standards Radio Laboratories.

Much remains to be accomplished before the Radio Chamber of Commerce completes its national scope and begins to function in its control of standard apparatus, but the new officials expressed themselves as well satisfied with the progress made and the co-operation promised by the Government officials.

Ain't It So?

By HARRY E. MALI

There's a certain fascination
When you have the inclination
Just to hear some stuff that's broadcast somewhere near.
But the height of satisfaction
If you really look for action
Is to hear a distant signal coming clear.

First the early days with crystal,
When you'd gladly use a pistol
On the bird who said you didn't get the coast.
Then the day when with elation
You first got regeneration
And you heard a call from Cuba, was your boast.

There's a certain fascination
When you have that inclination
Just to buy a set and listen with the rest,
But to scheme and save and barter
With some broom-wire for a starter
That's the way to get a knowledge of the best.

First the shaky old cat-whisker
Which would well nigh wear a blister
On your fingers while you're looking for a spot,
Then the regular progression
Till you reach the proud possession
Of a better set than ever could be bought.

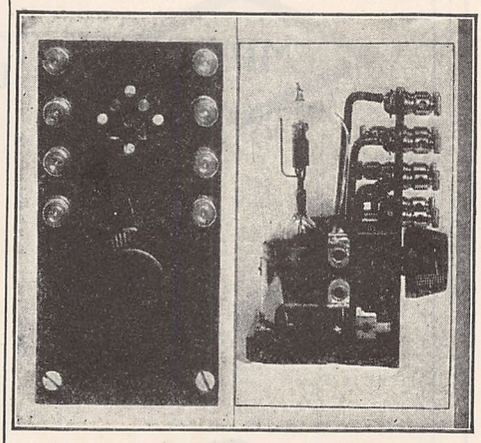
When you make your last connection
You decide with deep reflection
That you've gone about as far as you can go,
Then some other bird devises
A new hook-up that surprises
And you're off as hard as ever. "Ain't it so?"

WESTINGHOUSE ENGINEER A PIONEER IN RADIO BROADCASTING

ALMOST any radio amateur who owned a set capable of good range reception prior to 1921 is familiar with the history of station 8XK of Wilkinsburg, Pa., operated by Frank Conrad. These amateurs know of the phonograph concerts broadcasted by Mr. Conrad during a period of a year and which were heard as far west as the Catalina Islands. They may recall hearing his request for records one night and may have sent him one, for there were 500 records received in answer to his plea. This was early in 1920 before the radio broadcasting craze had swept the country and was, possibly, the first indication that radio broadcasting had some wonderful possibilities as a medium of entertainment.

KRL

High Grade V. T. Control Units



SPECIFICATIONS

PANEL: Bakelite Grade XX 4⅝x2⅜x⅛ inches. Most compact on the market.
BINDING POSTS. Polished nickel plated with holes for cord tips.
BASE: Bakelite ¾ inch into which is moulded tube receptacle. Contact springs of nickel plated phosphor bronze.
RHEOSTAT: High grade No. 120A Fada type.
GRID CONDENSER: Standard Dubilier Type 601 mica (not paper) .0005 M.F with adjustable grid leak.
PHONE CONDENSER. Standard Dubilier Type 601 mica (not paper) .001 M.F. wired across phones and B batteries, a distinctive feature.
WIRING: Heavy buss bar of No. 12 tinned copper protected by spaghetti tubing. Compact design insures lowest possible resistance in connections.
OPERATION: Signal strength guaranteed not to be excelled by any similar instrument.

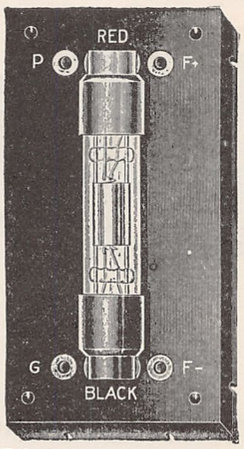
Price each, $5.75. Postpaid and insured. Radio frequency units of similar design with Murad transformer mounted on bakelite base in rear, $12.00. Audio frequency unit with Federal transformer, $13.00. With Thordarson transformer, $10.00. Units may be harmoniously connected.

Subject to return in five days after receipt if not satisfied. At your dealers or direct from

The Kehler Radio Laboratories
Dept. R ABILENE, KANSAS

RAC-AUDION

AUDION $5.00
5 TIMES THE AMPLIFICATION OF THE ORDINARY TUBE



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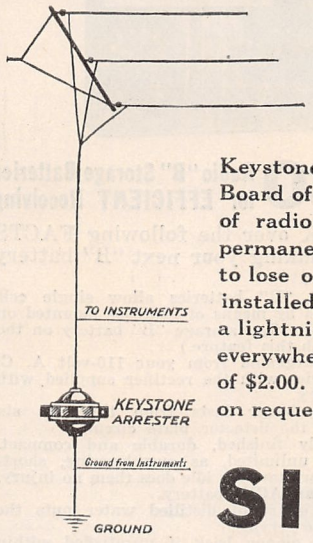
WRITE FOR INFORMATION AND DIAGRAM USING RAC CHOKE COILS

4 V-Fil 0.8 Ampere 60-Plate
New Jersey Radio Equip. & Install. Co.
120 BIDWELL AVE. JERSEY CITY, N.J.

MORSCAN

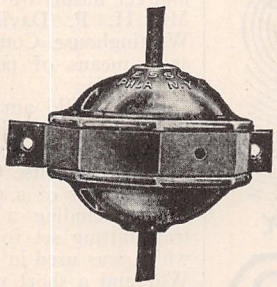
Wireless Supplies and Equipment at Wholesale

MORSCAN RADIO CO.
196 Market Street, Newark, N. J.

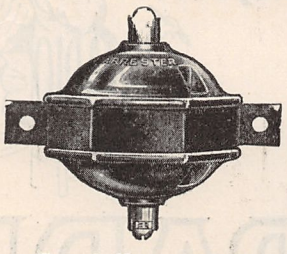


Keystone Radio Lightning Arresters

Keystone Arresters are approved by the Board of Underwriters for the protection of radio receiving sets. They provide permanent protection, have no vacuum to lose or fuses to blow. They can be installed outdoors and take the place of a lightning switch. For sale by Dealers everywhere or sent post paid on receipt of $2.00. Circular and Instructions free on request

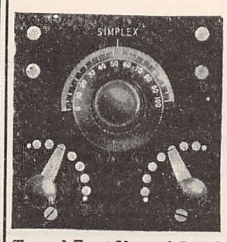


Type A, Keystone Radio Arrester. Retail Price $2.00

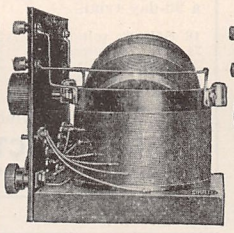


Type B, Keystone Radio Arrester. Retail Price, $2.00

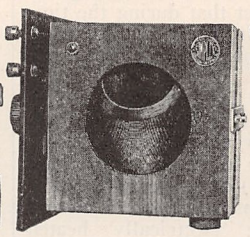
SIMPLEX PANEL UNITS



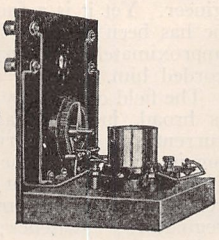
Typical Front View of Panels



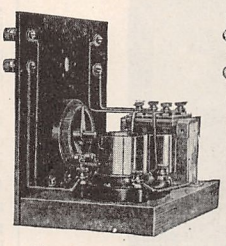
Simplex Vario-Coupler Panel



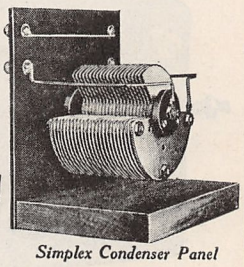
Simplex Variometer Panel



Simplex Detector Panel



Simplex Amplifier Panel



Simplex Condenser Panel

SIMPLEX PANEL UNITS make it possible to try out the many different hook-ups without disassembling panels. The beginner can first buy one vario-coupler panel and detector panel and get good results. Then he can add other units for greater sensitiveness and selectivity. Simplex instruments are always good and efficient. Circular on request. Sold by Dealers everywhere.

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Manufacturers of Lightning Arresters for 30 Years

Distributors for Simplex Radio Co.

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"Your Wants in Radio Will Be Filled at Once if You Tell Them to Missouri"

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No. UV-200 Detector	$5.00
No. UV-201 Amplifier	6.50
No. UV-202 5 Watt Transmitter	8.00
No. UV-203 50 Watt Transmitter	30.00
No. UV-204 250 Watt Transmitter	110.00

CUNNINGHAM TUBES

No. C-300 Detector	$5.00
No. C-301 Amplifier	6.50

SOCKETS

No. 30 Paragon	$1.00
No. 550 Murdock	1.00
No. UR 542	1.00
No. UP 552	1.50
No. UT 541	2.50

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No. 231-A General Radio	$5.00
No. A*2 Acme Semi-mounted	5.00
No. UV-712 Radio Corp	7.00

"B" BATTERIES

No. 763 Eveready, 22½ volts	$1.75
No. 5156 Burgess, 22½ volts	2.00
No. 766 Eveready, 22½ volts, extra large	3.00
No. 2156 BP Burgess, 22½ volts	3.00
No. 774 Eveready, 43 volts	5.00
No. 6880 Eveready, 110 amp. hrs.—52 lbs.	20.00

"If you do not see what you want listed here, send your order anyway. We'll fill it."

RADIO MISSOURI SUPPLY "Service Original"

RHEOSTATS

No. 810 Remler, 4 ohms	$1.00
No. 560 Murdock	1.00
No. 120-A Fada	1.00
No. 25 Paragon	1.50

ATWATER KENT UNITS

Variometer	$8.00
Variocoupler	8.00

REGENERATIVE RECEIVERS

No. CR-3 Grebe, 150 to 1000 meters	$65.00
No. CR-4 Grebe, 175 to 680 meters	65.00
No. CR-5 Grebe, 175 to 3000 meters	80.00
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No. CR-9 Grebe, 175 to 3000 meters with detector and two-stage amplifier, complete	130.00
No. RA Westinghouse, 150 to 700 meters	68.00
No. RC Westinghouse, 150 to 700 meters	132.50

LOUD SPEAKERS

No. R-3 Magnavox, 14-inch horn	$45.00
No. R-2 Magnavox, 18-inch horn	85.00
No. AC-2-C 2-stage amplifier	80.00
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TELEPHONES

No. 56 Murdock, 2000 ohms	$5.00
No. 56 Murdock, 3000 ohms	6.00
No. 2500 Manhattan, 2000 ohms	6.00
No. 2501 Manhattan, 3000 ohms	7.00

BALDWIN PHONES

Types C, E, F, G, per set	$16.00
Single Headsets, all types	9.00
Single Units (with cord)	8.00
Single Units (without cord)	7.75

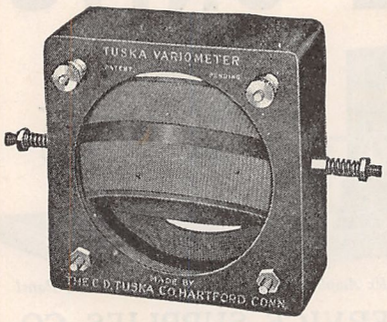
ANTENNA WIRE

No. 6 Braided Wire, per 100 feet	$0.50
No. 14 Bare Copper Wire, per 100 feet	.50

Please include sufficient postage with all C. O. D. orders

MISSOURI RADIO SUPPLY COMPANY

4623 Maryland Ave. SAINT LOUIS MISSOURI



Tuska Variometer Type 200

The Tuska Variometer was the first moulded Variometer on the market; not only first to arrive, but first in quality.

All TUSKA RADIO follows this example. The name Tuska is a standard. Insist on Tuska Sets and Tuska Parts.

Send 5c for Tuska Catalog No. 3

The C. D. Tuska Company

12 Bartholomew Ave., Hartford, Conn.

DEALERS! DEALERS!

We are Distributors of

DeFOREST RADIO EQUIPMENT

Western Electric and Stromberg-Carlson Phones

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MUSIO RADIO SET

Send for New Catalog

Wholesale Only

Prompt Delivery

North American Radio & Supply Corporation

Formerly Aldan Accessory Co.

5 Columbus Circle, New York

8XK has not been very active during the past two years for KDKA, of the Westinghouse Electric & Manufacturing Co., at East Pittsburgh, Pa., has taken its place as the broadcaster of Pittsburgh and environs. But even so, little 8XK was the forerunner of powerful KDKA and actually was the indirect means of bringing the attention of Mr. H. P. Davis, vice-president of the Westinghouse Company, to the radiophone as a means of popular entertainment and instruction.

Many radio amateurs who know Frank Conrad as a broadcaster of ability may not know that he is assistant chief engineer of the Westinghouse Company and, besides being inventor of a great deal of radio apparatus, including a combined receiving and transmitting set for the U. S. Signal Corps which was used in France during the World War and a short wave meter, is one of the most prolific electrical inventors of the present day.

The radio amateurs know Frank Conrad as a radio amateur of ability, but few of them know that he stands near the top of his profession as an electrical designing engineer. Yet it is a fact that during the time he has been engaged in electrical designing, approximately 120 patents have been accorded him.

The field covered by the Conrad inventions is broad, including as it does alternating-current and direct-current electrical measuring instruments of the indicating integrating (including prepayment) and recording types; relays and relay systems; voltage and current regulators; switches; electrically heated boilers; arc lamps; dynamo-electric machines; transformers; motor-control systems; systems of electrical distribution; mercury-vapor rectifiers; automatic synchronizers, phase relation indicators; ground detectors; bakelite micarta gears; starting, lighting and gear shifting and ignition systems for automobiles; carburetors, hand grenades and radio telegraphy and telephony.

Despite his 30 years of service with the Westinghouse Company, Mr. Conrad is a comparatively young man as executives go. He was still in his 'teens when he secured a job with the Westinghouse Company then located in Garrison Alley in a very small building, and as his friends have stated, has been growing with the company and the electrical industry ever since.

Mr. Conrad is a flawless reasoner and attacks any subject with the same avidity with which he goes into engineering problems. He is able to concentrate so thoroughly upon what he reads that it is said he never forgets what he once has grasped. As those who know him state, he can remember the gist of the contents of every book he has ever read. For this one reason, perhaps more than others, he is remarkably well informed upon practically every scientific subject of modern times.

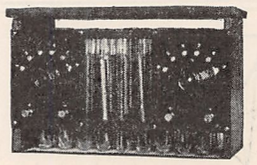
He is responsible in no small measure for the success of KDKA, as his experience gleaned in amateur broadcasting was available in perfecting this station. In fact, Mr. Conrad was the first person called in, when Mr. H. P. Davis, who first saw the radio broadcasting vision, determined to establish the first radio broadcasting station in the world to broadcast nightly concerts.

Romantic Rancher Proposes to Unseen Radio Artiste

Bachelor girls, sing for the radio!

Accept this tip if you are looking for a husband!

Miss Ivy Buchtman, who sings every once in a while at the broadcasting station of the Crosley Manufacturing Company, Cincinnati, Ohio, the call letters of which are WLW, will tell you that radio and romance go hand in hand, her assertion being based on the following letter which she recently received:



KICO Radio "B" Storage Batteries for EFFICIENT Receiving

THINK over the following FACTS before making your next "B" battery purchase:

1. KICO "B" batteries allow single cell adjustments by means of switches mounted on panels. (The first storage "B" battery on the market with this feature.)
2. Rechargeable from your 110-volt A. C. line in series with the rectifier supplied with each battery.
3. One charge lasts from three to six months in the detector plate circuit.
4. Highly finished, durable and compact.
5. Life unlimited, as overcharging, short-circuiting or standing idle does them no injury.
6. Not an ACID battery.
7. One quart of distilled water puts the battery into service.
8. Your money back if unsatisfied within a 90-day trial.

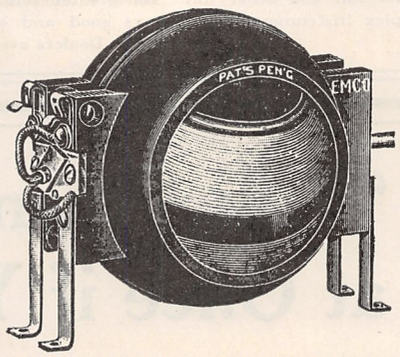
		(Plain)	(Panels)
16 cell	22 volts	$6.50	.....
24 cell	32 volts	8.00	$12.00
36 cell	48 volts	10.00	14.00
50 cell	68 volts	12.00	17.00
78 cell	100 volts	16.00	21.00

Drop us a line for literature.

KIMLEY ELECTRIC COMPANY

290 WINSLOW AVENUE, BUFFALO, N. Y.

KLEIN'S RADIO and ELECTRIC SUPPLY CO.



EMCO MOULDED VARIOMETER

Moulded out of pure bakelite; removable legs for panel mounting. Pig-tail connection, eliminating bearing connection. Price, **$7.50**

Send for our complete catalog of most modern Radio Equipment (including diagram of New Armstrong Regenerative Circuit,) mailed Free everywhere. MAIL ORDERS receive immediate attention.

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34 PARK PLACE (near Woolworth Bldg.,) **NEW YORK**

RADIO DEALERS AND MANUFACTURERS

We have them—all parts needed for the radio trade promptly delivered.
Send us your requirements for prices

SMITH ENGINEERING CO.

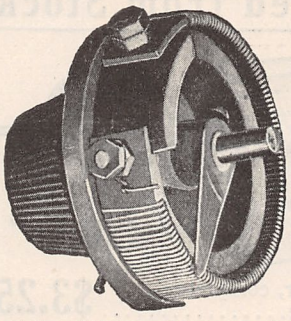
One Union Square New York City

International Radio Corporation

DEALERS—Write for Prices

We manufacture receiving sets, variable condensers, variocouplers, variometers, sockets, rheostats and parts for assemble of radio receiving apparatus.

Dept. A, 42 Branford Pl., Newark, N. J.

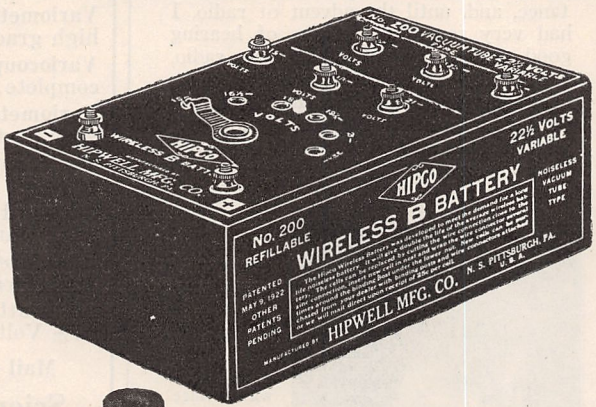


HIPCO

SEE THAT SWITCH

No. 200-The New Improved Hipco Wireless B Battery

The Rotary Switch Lever makes it easy to instantly get any desired voltage. No resistance to overcome, therefore, no loss of energy.



It is also Refillable and Variable same as other styles of Hipco B Batteries and is especially designed for Vacuum tube work on plate circuits and is guaranteed to be perfectly noiseless.

No. 200-22½	Volts,	Price	**$3.50**
No. 100-22½	Volts,	"	**3.00**
No. 140-22½	Volts,	"	**2.00**
No. 245-45	Volts,	"	**4.00**

The Hipco Rheostat is especially designed for filament control of vacuum tubes. It operates on 4 to 6 volts. The resistance is made of a non-corrosive alloy and can be very readily renewed.

Made with several styles of knobs to match various dials.

List Price, **$1.00** each.

Phone Condensers .001 MFD. at	**35c**
Phone Condensers .002 MFD. at	**35c**
Grid Condensers .0005 MFD. at	**35c**
Grid Condensers .00025 MFD. at	**35c**
Grid Leak Condensers. 0005 MFD. at	**50c**
Grid Leak Condensers .00025 MFD. at	**50c**

For Sale at all Radio Supply Dealers

HIPWELL MFG. CO. N. S. Pittsburgh, Pa.

BUY A HIPCO MULTIPHONE

Price $5.00 Complete With Four Sets of Head Phones

Let your friends and family listen in—reproduction 100% perfect. No trouble—nothing to get out of order.

ROTARY SWITCH LEVERS

With same knob as illustrated

No. 1-1¼ Radius
List Price **50c** ea.

No. 2-1½ Radius
List Price **55c** ea.

No. 3-1 Radius
List Price **50c** ea.

We also manufacture same with knob to match Rheostat illustrated.

WHY WASTE YOUR TIME WIRING?

Hook up with the "Socostat"!

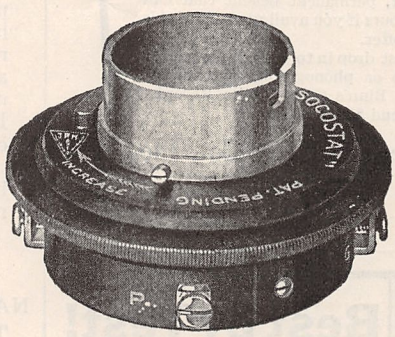
HERE is a combination of socket and rheostat that eliminates the wiring of two separate parts. Saves time, material and money.

No exposed wires. The internal rheostat permits very sensitive filament adjustment. Tube noises reduced to a minimum. Bakelite base and cover. Nickel-plated receptacle takes any standard detector and amplifier tube. Rings and screws all nickel-plated.

Simplify your construction, and improve appearance and operation of your set.

Jobbers and Dealers write Automotive Electric Service Corp., 206 Amsterdam Ave., New York City.

"SOCOSTAT"



Single-Unit Socket and Rheostat for table or panel mounting.

Guarantees a smooth and positive contact.

Price $2.50 each

Buy from your dealer, or if he cannot supply this new, improved device, send the money to us with your dealer's name and we will send direct, parcel post, prepaid,

Descriptive literature on request.

Manufactured by

FEDDERS MFG. CO., Inc.

57 Tonawanda Street **Buffalo, N. Y.**

The fastest way to learn the RADIO CODE

LISTENING to radio concerts is only half the game. The first step to a real knowledge of wireless signalling is the knowledge of the code. Then, once mastered, the real delights of radio will be yours. Think of listening to a steamer 200 miles out at sea; think of picking up messages vital and amusing; think of the fun of getting in touch with your pals; of "getting" Arlington, St. John, Cape Race or Chicago.

A simple, logical method

All this is possible—nay, easy, if only you know the code. Now, a new way has been developed for learning it, something so simple and logical that you will wonder that no one has ever done it before.

Jack Binns has made two phonograph records that are marvels of simplicity and clearness and, with their help you can learn the code in one evening—think of that.

And with them you get a book explaining the complete short-cut system on which the records are based.

2 Records and Text-Book —all for $2.00 or Book alone—50c.

The price of two dollars is ridiculously small as compared with the great, permanent benefit that can be yours if you avail yourself of this big offer.

Just drop in to your dealer, either radio or phonograph, and ask for Jack Binn's OKeh Radio Records. Or send $2.00 to the

American Code Co., Inc.
206 Broadway
NEW YORK CITY

Best by Test!

TRADE MARK

GALENA ALL SENSITIVE GALENA CRYSTAL

Hundreds of manufacturers, dealers and owners of receiving sets everywhere have tested and found our crystals the most sensitive and efficient obtainable.

Double your pleasure and increase the efficiency of your set by using our

ALL-SENSITIVE GALENA CRYSTALS.

Galena Crystal, Mounted 35c
Galena Crystal, Unmounted ...25c

IMMEDIATE DELIVERY

Every Crystal
GUARANTEED PERFECT

Manufacturers, Jobbers, Dealers, write for quantity prices

GALENA CRYSTAL MFG. CO.
464 Bushwick Ave. Brooklyn, N.Y.

"Chikasha, Okla.
"June 10.
"My dear young lady:

"You will please pardon the liberty I take in writing to you. I have never met you personally, but, after hearing your lovely voice over the radio, I am so charmed that I am compelled to tell you how happy you have made me and how anxious I am to meet the charming possessor of such a marvelously beautiful voice.

"I am the owner of a large ranch many miles from any town of importance, and, until the advent of radio, I had very few opportunities of hearing good music. But thanks to the radio, which has conveyed the beautiful tones of your voice to me here, and I am now looking forward to the time of the year when I again will be able to hear WLW, where, I understand, you sing quite regularly.

Miss Ivy Buchtman, whose voice so charmed a Radio listener that he wrote the accompanying letter, which shows what Radio can do in the matrimonial way.

"Now the prime object of this letter is to endeavor to arrange to meet you; that is, if you are young and not married. I am 30 years old, wealthy, and considered good looking. I never experienced an extra pulse-throb until I heard your sweet voice on the WLW radio. Please tell me if there would be any objection to my coming to Cincinnati to meet you and your parents. May I send you one of my photos and in exchange will you send me one of yours?

"Hoping I may have the pleasure of hearing from you, please allow me to remain,

"Yours respectfully,
"J. M."

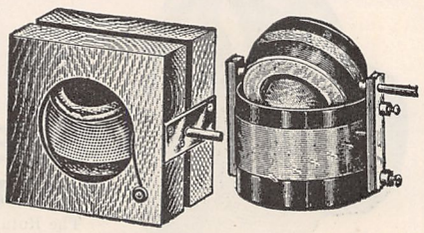
NAVY BROADCAST FOR AMATEURS DURING THE MONTH OF JULY, 1922

July 1—English—Wayne Franklin Rositer your application for amateur registration was received without address Please forward same to complete form

July 2—Code two—Pearl Harbor call letters NPM transmits with arc set on eleven thousand five hundred meters at one thirty a m three thirty a m one thirty p m and six fifty five p m seventy fifth meridian time

July 3—English—following additional list of call letters assigned by Department of Commerce during week of June nineteenth nineteen twenty two WGAD Spanish American School of Radiotelegraphy Ensenda P R WGAF Goller Radio Service Tulsa Okla WGAG Wisconsin Radio Show Milwaukee Wisc WGAH New Haven Electric Co New Haven Conn KFAD McArthur Bros Mercantile Co Phoenix Ariz KFAE State College of Washington Pullman Wash KFAF Western Radio Corp Denver Colo changed from KDZU

Shipped from Stock



Variometer, complete, high grade	$3.25
Variocoupler, high grade, complete	2.75
Variometer Parts, all necessary parts except wire	1.50
Variocoupler Parts, complete set except wire	1.00
Standard Head Sets, 2,000 Ohms	4.90
Thordarson Amplifying Transformer	3.50
"B" Battery, Ra-o-vac, 22½ Volts	1.10

Mail Orders Promptly Filled

Scientific Dealers Supply Company
2727 Fullerton Ave. Chicago, Ill.

Quality Radio Supplies at Right Prices

"Long Distance Variometers—Plate or Grid."
Polished blocks, natural or brown color.

Mahogany, cotton winding $4.25 Green Silk $4.75
Poplar, cotton winding 3.75 Green Silk 4.25
Unassembled, deduct 75c. Parts without winding, deduct 2.00
Stator windings, cotton, set 50c Green Silk 1.00

VARIO COUPLERS

Bakelite Tube, cotton winding $3.00 Green Silk $3.35
Varnished Tube, cotton winding 2.50 Green Silk 2.85
Unassembled, deduct 50c. Parts without wire, deduct 1.50
Mahogany rotors 35c Poplar 25c

VARIABLE CONDENSERS AND DIALS

3 Plate .00005 $1.90 23 Plate .0005 $3.00
7 Plate .0001 2.40 43 Plate .001 3.50
11 Plate .0003 2.60 3" Dials . . .60

Money back guarantee. Send stamps for mfgrs. bulletin. Quantity discounts. Dealers and agents wanted. Special purchasing service for the trade.

McCONNELL CABLE AND SPECIALTY CO.
426 South Clinton Street, Chicago, Ill.

Radio Supplies

All Standard Goods—Immediate Deliveries

Kellogg, Manhattan, Teleradio Head Sets, Dials, Rheostats, Audio & Radio Frequency Transformers, Variable Condensers, Variocouplers, Bakelite Rotors and Stators, Jacks, Plugs.

A *Complete* Line. Largest Stock in the Middle West. Write for Catalogue.

DEALERS—ATTRACTIVE DISCOUNTS

AMERICAN RADIO MFG. CO. Dept. A.
107 E. 13th St., KANSAS CITY, MO.

RADIO FREQUENCY AMPLIFIERS

That Give Clear Long-Distance Reception With Loop Aerial

Write now for data and prices

MASSEY RADIO COMPANY
Winchester - - - Virginia

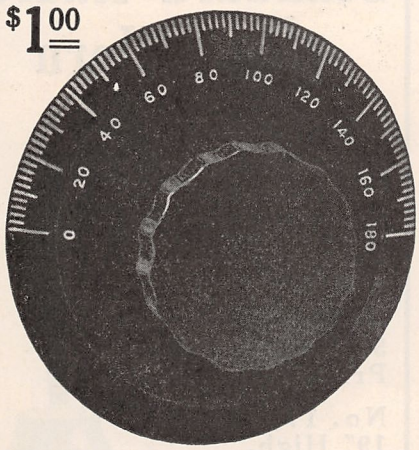
STEINER ELECTRIC CO.
115 N. Wells St., Chicago

RADIO SUPPLIES

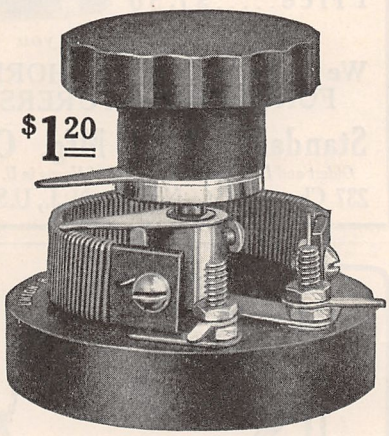
Branch Store—5239 N. Clark St.

Wholesale and Retail

$1.00



$1.20



CERTIFIED
UNION RADIO
Apparatus and Accessories

As a result of our endeavor to bring forth a high quality line of Radio Apparatus and Accessories, we are proud to announce that the four Union Radio parts shown in this advertisement have had the "Certified" stamp of approval placed on them by the New York "Evening Mail," and other recognized Testing Laboratories.

As all Union Radio Apparatus and Accessories are guaranteed by us without any reservation whatsoever as to workmanship and material, we stand ready at all times to replace or repair any Union Radio Set or part, which may not come up to the high standard of quality that we have established.

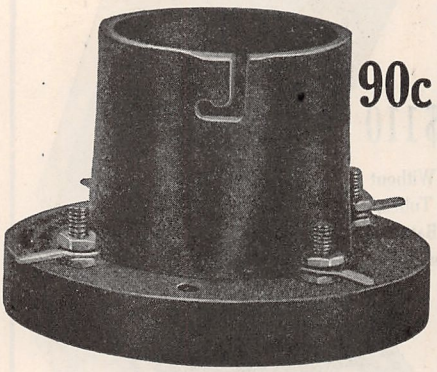
Knowing that the real earnest amateur can get satisfactory results only from the very best equipment, we urge your consideration, inspection and comparison of Union Radio apparatus and accessories.

Our catalogue "RADIO APPARATUS 'C'" illustrates and describes our complete line of Radio Apparatus and Accessories—Write for your catalogue today.

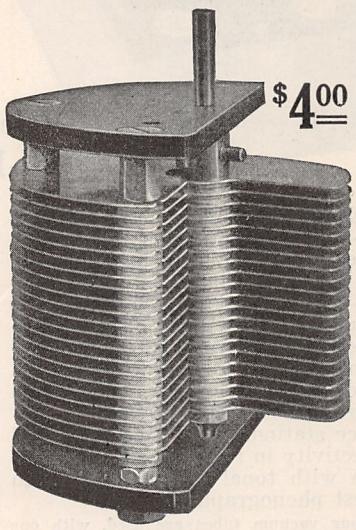
RETAILERS AND DISTRIBUTORS

Write for samples of Union Radio guaranteed and reasonably priced "Quality Products." Liberal terms and trade discounts.

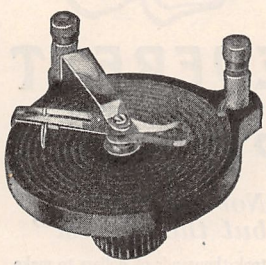
UNION RADIO CORPORATION
200 MT. PLEASANT AVENUE, NEWARK, N.J.
NEW YORK OFFICE 116 WEST 32nd STREET.



90c



$4.00



Patent Pending

The picture tells the story

THIS VERNIER RHEOSTAT differs from others the same as a violin differs from a mandolin. Any vibration can be tuned exactly without gaps or breaks.

The finest and most perfect adjustment can be made by the turn of a single knob. It is really a new and radical departure from all standard types.

Price
$1.50

The New Marco Vernier Rheostat
Type 100-A—Resistance Capacity 6 Ohms

The resistance unit is made of the finest resistance material known—Ni-Chrome Wire
No drilling of screw holes in panel.
Smooth and noiseless in operation.
Moulded parts made of Bakelite.
No screws necessary. Nothing to wear.

MAR-CO RADIO PRODUCTS

MARTIN COPELAND CO., *Providence, R. I.*

MAR-CO RADIO PRODUCTS

$110

Without Tubes, Batteries or Phones

Type VC-1

Everybody likes VOLUTONE VC-1—its appearance as well as the tone and volume of the broadcast on local and long distance work. VC-1 is the result of original thought on the part of radio engineers who have experimented for months to develop an ideal long distance home receiver, simple to operate, a loud speaker on long distance stations, a greater degree of selectivity in tuning, and reproduction with tonal qualities equal to finest phonograph.

Four vacuum tubes are used, with one stage radio frequency and two stages audio frequency amplification. Entire receiving unit mounted to bakelite panel. Mounts with controls on top in genuine quartered oak, walnut or mahogany cabinet. Separate compartment for "B" batteries and loud speaker built into cabinet. Filament control on four tubes, with potentiometer adjustment.

You will like it, too, when you see our Bulletin RN-2. Write for it today and ask your dealer to demonstrate the VOLUTONE VC-1. There is nothing else like it and we believe it will produce better results than sets selling at twice the price, $110, without tubes, batteries or phones.

DEALERS and JOBBERS write for introductory offer

THE VOLUTONE COMPANY

141 WEST OHIO ST., CHICAGO, ILL.

GITHENS TRUTONE RADIO HORN—LOUD SPEAKER

First one to sell on ten day trial Money back Guarantee

Retail Price $21.00 Includes Loud Speaker

Trutone has been pronounced the best on the market by experts. It has a clear true tone. Every radio fan should try Trutone and compare it with others.

If YOU don't find Trutone the best, your money will be refunded. It is sold on a ten-day trial money-back guarantee. If not carried by your dealer write us.

Distributors and Dealers, write!

AUTO PARTS MFG. CO.

1017 Trombly Ave., Detroit, Mich.

July 5—English—The Weather Bureau Department of Agriculture recently published pamphlets explaining the method of transmitting weather reports forecasts and warnings by Naval radio stations for the benefits of marine interests these publications may be obtained from the above named Bureau upon application

July 6—Code Six—US radio station Annapolis Md broadcasts time at eleven fifty five a m time and press at nine fifty five p m seventy fifth meridian time on wave length of seventeen thousand one hundred forty-five meters

July 7—Code eight—US Navy radio station Washington D C call letters NAA transmits time at eleven fifty five a m time weather and press at nine fifty five p m seventy fifth meridian time on wave length of twenty six hundred fifty meters

July 8—English—The following radio call letters were assigned during the week beginning June twenty fifth nineteen twenty two WGAY North Western Radio Co Madison Wis WGAZ South Bend Tribune South Bend Ind KFAJ University of Colorado Boulder Colo WHAB Clark W Thompson Fellmans Dry Goods Co Fayetteville Ark WHAC Cole Bros Electric Co Waterloo Ia WHAD Marquette University Milwaukee Wis WHAE Automotive Electric Service Co Sioux City Ia WFAF Radio Electric Co Pittsburgh Pa

July 8—English—The following radio call letters were assigned during the week beginning June twenty sixth nineteen twenty two WGAR Southwest American comma Fort Smith Ark WGAS Roy Di Co organization Chicago Ill WGAT American Legion Dept of Nebraska Lincoln Nebr WGAU Marcus G Limb Wooster Ohio WGAV B H Radio Co Savannah Ga WGAW Ernest C Albright Altoona Pa WGAX Radio Electric Co Washington Ohio Temporary

July 4—English—Following additional list of radio call letters assigned to stations during the week of June nineteenth by Department of Commerce WGAJ W H Gass Shenandoah Iowa WGAK Macon Electric Co Macon Ga WGAL Lancaster Electric Supply and Construction Co Lancaster Pa WGAM Orangeburg Radio Equipment Co Orangeburg S C WGAN Cecil E Lloyd Pensacola Fla WHAA State University of Iowa Iowa City Iowa WGAQ W G Patterson dash Glenwood Radio Corpn Shreveport La

July 11—English—the USS ILLINOIS will sail Saturday July fifteenth for a two weeks training cruise for naval reservists period it is planned to visit Bermuda period applications for enrollment are being received on board the ILLINOIS at ninety seventh street and North River New York City

July 12—English—Endeavors to establish a Navy American Radio Relay League station at the US Navy Radio Station Navy Yard New York have been abandoned owing to present economic conditions

July 14—English—The following broadcasting stations have been assigned radio call letters during the week beginning July third WHAM University of Rochester Rochester N Y KFAN Electric Shop Moscow Idaho KFAP Standard Publishing Co Butte Mont KFBA Ramey & Bryant Radio Co Lewiston Idaho KFAQ City of San Jose San Jose Cal KFAR Studio Lighting Service Co O K Oleson Hollywood Calif WHAN Southwestern Radio Co Wichita Kans WHAO Frederick A Hill Savannah Ga

July 17 1922—English—Beginning Wednesday July nineteenth and each Wednesday and Friday thereafter the United States Navy Yard New York will retransmit the Marine Band and Washington Navy Yard Band concerts beginning at nine thirty p m daylight saving time on wavelength four

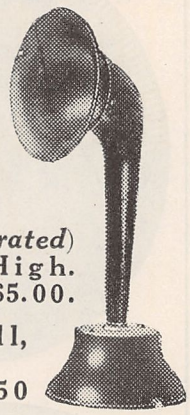
Standard Radio Horn

TRADE STANDARD MARK

Patent applied for

Special Design

Will fit any receiver. Heavy material, no blast. Rubberoid Enamel finish.



No. 15 (*as illustrated*) 5″ Bell, 14″ High. Price.....$5.00.

No. 17, 7″ Bell, 19″ High. Price.....$7.50

Your dealer can supply you

We figure on SPECIAL HORNS FOR MANUFACTURERS

Standard Metal Mfg. Co.

Oldest and Largest Manufacturers of Horns in U. S.

237 Chestnut St., Newark, N. J., U.S.A.

EVERETT

DOUBLE RADIO

PHONES

"Not the loudest but the clearest"

It took thousands of dollars to make them what they are—

Millions would not have made them better, yet a pair today costs only

$8.50 At All Dealers

EVERETT ELECTRIC CORP.

320 BROADWAY NEW YORK

SAY, FELLOWS

Save those radio profits by using our blue prints. Make VT equipment; don't be satisfied with an obsolete crystal set. Learn the radio game thoroughly by making your parts. Stamp brings full particulars.

The Plan Bureau

1929 McCausland Ave. St. Louis, Mo.

Newark Wireless Exchange

We carry all makes of Wireless Apparatus

Send 10 cents for catalogue

87 Halsey St. Newark, N. J.

Now Ready!

The DICTOGRAPH Radio Loud Speaker *for the Home*

THE Radio public has been waiting for the Dictograph Radio Loud Speaker. Perfected by Dictograph Products Corporation, the pioneer manufacturer of loud-speaking telephones, and world-famous for its sound-transmission instruments; the same supreme quality as other Dictograph products.

Years of experience have made possible this new Loud Speaker—**the best in the world**—and sold at a price that gives you DICTOGRAPH quality at no extra cost. The great, assured demand has made possible a reduction from the price originally announced. Instead of $25, it is **only $20—complete with 5 ft. flexible cord.**

See the Dictograph Loud Speaker at your dealer. Dealers can be supplied by local jobber—or inquire direct.

Price $20
Complete with 5 ft. flexible cord

The Standard of the World

DICTOGRAPH Radio HEAD SET

Ask for the Dictograph Head Set—the **best Head Set in the world, regardless of price.** The name Dictograph is your guarantee of supreme quality. It insures the most sensitive and accurate transmission of sound known to Radio.

The Dictograph Loud Speaker is beautifully constructed; the cabinet is of hardwood, ebony finished, with die cast black enameled aluminum tone arm. The horn is spun copper, highly polished, French lacquered, non-tarnishable. Completely equipped with 5 ft. flexible silk cord. For any vacuum tube receiving unit. No extra batteries required.

DICTOGRAPH PRODUCTS CORPORATION
220 WEST 42d STREET (*Branches in All Principal Cities*) NEW YORK CITY

Let Your Apparatus Speak for Itself

AMERICAN RADIO EXPOSITION

—A national exposition for radio manufacturers, dealers, inventors and amateurs, covering the entire field of radio.
—A complete exhibition of apparatus, accessories and materials.
—Daily demonstrations, broadcasting, lectures, orchestral concerts, Grand Opera artists in person—motion pictures illustrating practical uses of radio and the principles of its operation.

To be held at

Grand Central Palace

46th to 47th Sts. & Lexington Avenue

—**The heart** of the great terminal zone, close to the busiest shopping districts.

NEW YORK CITY
DECEMBER 21st to 31st, 1922

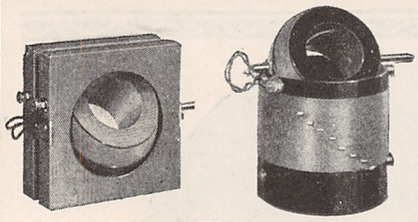
—Schools and colleges will be closed, making it convenient for young folk to attend. To these young people the magic of radio makes a specially strong appeal.

Manufacturers and dealers should contract for space now
Address inquiries as to rates, etc., to

AMERICAN RADIO EXPOSITION COMPANY

120 Broadway, New York City Telephone, John 0009

Educational and Interesting



Ra-Fone

Variometer
$3.80

Stators 4½ inches square, rotors 3½ inches. Double cotton covered windings, No. 22 wire set in insulating varnish. Flexible leads to 3½-inch secondary. Clear insulating varnish finish. Mounts flat to panel with 2 countersunk screws.

Vario-Coupler
$3.80

Primary wound on 4-inch black dielectric tube with 9 single taps and 8 nine-turn taps. Taps are soldered on brass strips and turned to allow easy soldering connection for user. Rotor 3 11/16 inches in diameter, making very close coupling with primary. Rotor finished with flexible leads through hollow rotor shaft. Primary and secondary both wound with No. 22 green silk covered copper wire — 44 turns on rotor, 80 turns on primary. Finished with clear insulating varnish.

Both guaranteed to be of very best material and workmanship and to receive perfectly up to 500 meters when properly installed. Immediate shipment by parcel post on receipt of price. Satisfaction guaranteed or money back.

Ra-Tone Electric Co. 919 Park Place West DETROIT, MICHIGAN

HYGRADE SPECIALS

Radiotron U.V., 200 Tubes	$4.75
Radiotron U.V., 201 Tubes	5.75
No. 766 Eveready Variable B. Battery	2.25
45-Volt Cyclone Variable B. Battery	2.75
Electrose Insulators, per dozen	2.00
7-Stranded Copper Aerial Wire, 200 Ft.	1.25
Arkay Loud Speakers	4.00
.001 M.F. Signal Variable Condensers (with dial and knob)	4.50
Thordarson Amplifying Transformers	3.89
Acme Amplifying Transformers (Semi-mounted)	4.25
Federal Amplifying Transformers	6.25
Skindervikin Transmitter Buttons	.75
Murdock No. 56 Head Set, 3000 Ohm	5.75
Murdock No. 56 Head Set, 2000 Ohm	4.75
Federal 2200 Ohm Head Set	7.25
Dictograph 3000 Ohm Head Set	9.95
Western Electric Head Set	12.50
Rheostats, Fada 90—De Forest	1.05
MARKO STORAGE BATTERIES	
6 volt 30 amp., guaranteed 2 years	10.00
6 volt 60 amp., guaranteed 2 years	13.50
6 volt 80 amp., guaranteed 2 years	17.00
6 volt 100 amp., guaranteed 2 years	21.00
Homecharger, charge your own battery	16.50

Above prices are F. O. B. New York

HYGRADE ELECTRICAL NOVELTY CO.
41 WEST 125th STREET, NEW YORK, N. Y.

Armco Ingot Iron
for Electrical Uses
in Cold Rolled Strips and Bright Drawn Shapes and Bars

Silicon Electrical Sheets for Radio
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Ward's Permanent Magnet Steel
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one two meters (412 meters)

July 18—English—Radio amateur broadcast the amended weather broadcast schedule for the Arlington Radio Station NAA is as follows ten a m state weather forecast on five nine five zero meters X arc ten thirty a m Marine and aviation bulletin on five nine five XXX zero meters arc five p m special forecast and warnings on five nine five zero meters arc ten p m state weather forecast on two six five zero meters spark ten thirty p m Marine and aviation bulletin on two six five zero meters spark the marine and aviation bulletin will be immediately followed by hydrographic information

July 20—English—US Naval radio station Arlington Virginia call letters NAA broadcasts separate weather forecasts for each of the States east of the Mississippi except Indiana Wisconsin and Illinois and a general forecast for the section comprised therein at ten a m on a wavelength of five nine five zero meters arc and ten p m on a wavelength of two six five zero meters spark on Wednesdays from April first to October fifteenth inclusive period A summary of weather conditions as they affected crops during the previous week will also be included period times are seventy fifth meridian

July 21—English—Norfolk Va call letters NAM transmitting on one eighty five one meters spark broadcasts at ten forty five a m wind and weather forecasts and storm warnings for Virginia and North Carolina coasts advisory messages regarding storm warnings issued for Chesapeake Bay and middle and south Atlantic coasts and at four and eight p m storm warnings and advices issued in afternoon

July 22—English—Charleston SC call letters NAO transmitting on two two five zero meters spark broadcasts at ten thirty a m wind and weather forecasts and storm warnings for South Carolina coast advisory messages relating to storm warnings issued for middle south Atlantic and east Gulf Coasts and eight a m barometric pressure wind direction and velocity and state of weather at Charleston and at six p m storm warnings and advices issued in afternoon

July 23—English—Savannah Georgia call letters NEV transmitting on one eight one three meters spark broadcasts at eleven a m wind and weather forecasts and storm warnings for Georgia coast advisory messages relating to storm warnings issued for middle and south Atlantic and east Gulf coasts and eight a m barometric pressure wind direction and velocity and state of weather at Savannah and at six p m storm warnings and advices issued in afternoon

July 24—English—Jacksonville Florida call letters NFI transmitting on four five zero meters broadcasts at eleven a m wind and weather forecasts and storm and hurricane warnings for East Florida coast Jacksonville to Miami advisory messages relating to storm warnings issued for middle and south Atlantic and east Gulf coasts and eight a m barometric pressure wind direction and velocity and state of weather at Jacksonville and Titusville and at six p m storm warnings and advices issued in afternoon

July 25—English—Baltimore Maryland call letters NBZ transmitting on seven hundred meters spark broadcasts at ten thirty a m wind and weather forecasts and storm warnings for Chesapeake Bay advisory messages regarding storm warnings issued for middle and south Atlantic coasts and eight a m barometric pressure wind direction and velocity and state of weather at Baltimore and Norfolk and at four p m storm warnings and advices issued in afternoon

July 26—English—Philadelphia Pa call letters NAI transmitting on one nine four eight meters spark broadcasts at ten forty five a m wind and weather forecasts and storm warnings for New Jersey Delaware and Maryland coasts advisory messages re-

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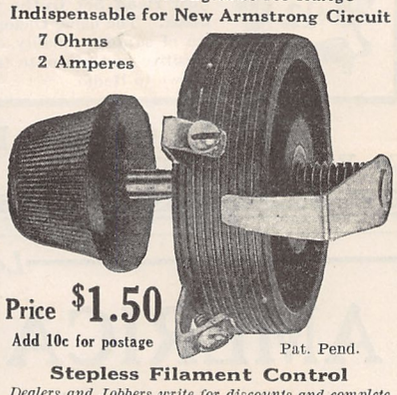

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(Patents Pending)

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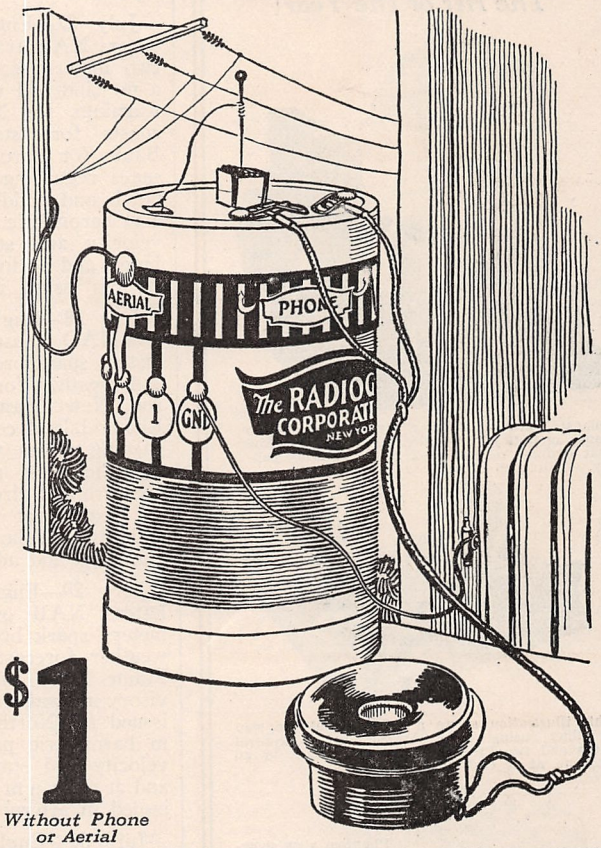

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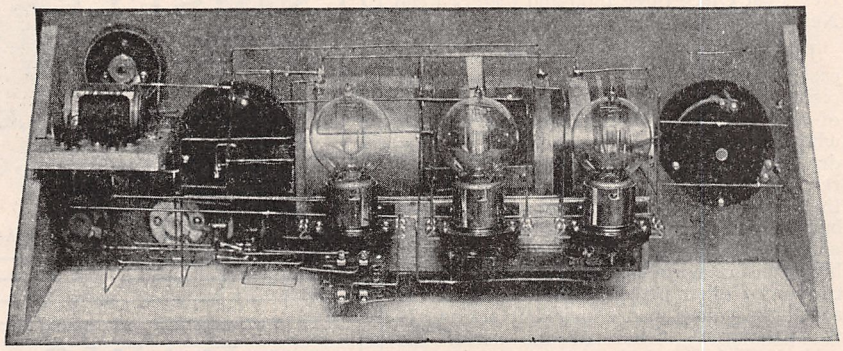

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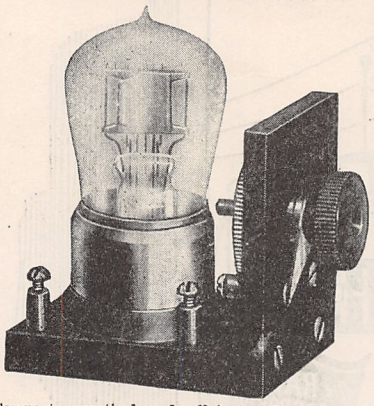
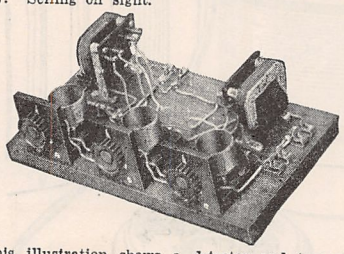
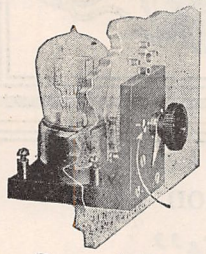


Compact, practical and efficient. For table or panel mounting. Moulded hard rubber. Rheostat 6 ohms resistance—2 amps. carrying capacity. Selling on sight.



This illustration shows a detector and two step amplifier using three Precel audion control units and two Precel transformers. Built by an amateur at a cost of $17.00.



Phantom view showing **Precel audion control unit** mounted back of panel using but two screws.

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Mfrs. of Precel Sets and Parts

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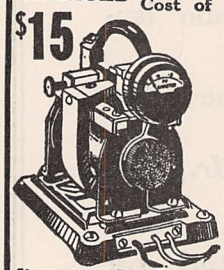

F-F BATTERY BOOSTERS Charge Automatically Operating Unattended. Leave Your Battery just where it is, without even disconnecting it, Screw Plug in Lamp Socket; Snap Clips on Battery Terminals; Turn Switch and Battery is Charged in Morning. Is it not gratifying to feel that Your Radio Batteries will never fail and You will be always Ready to Receive All Radiophone Broadcast Music, Sermons & News, never having to be careful of, or tell Friends Your Batteries are dead? Charges Auto & Radio Batteries Both Waves of Current are Rectified thru Adjustable & Easily Renewable Infusible Carbon Electrodes, which Maintain a Constant Efficiency & Last thousands of hours. Also Charges Batteries right in Auto. No Skill Required. AMMETER Shows Current Flowing. Eliminating Guess Work. COMPLETE, COMPACT, SELF-CONTAINED PORTABLE AUTOMATIC CHARGING UNITS. F-F Battery Boosters are Full Wave Magnetic Rectifiers for 105-125 Volt 60 Cycle A. C. POPULAR PRICES.

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Can. Rep.: Battery Service & Sales Co., Hamilton, Ont., Can.

garding storm warnings issued for north and middle Atlantic coasts and eight a m wind direction and velocity and state of weather at Delaware Breakwater and at five p m storm warnings and advices issued in afternoon

July 27—English—New York NY call letters NAH transmitting on one eight three two meters spark broadcasts at ten thirty a m wind and weather forecasts and storm warnings for New York and Connecticut coasts forecasts Sandy Hook to Grand Banks for European steamers advisory messages regarding storm warnings issued for north and middle Atlantic coasts and eight a m barometric pressure wind direction and velocity and state of weather at Sandy Hook and at five p m storm warnings and advices issued in afternoon

July 28—English—Boston Mass call letters NAD transmitting on two two five zero meters spark broadcasts at eleven a m wind and weather forecasts and storm warnings for New Hampshire Massachusetts and Rhode Island coasts advisory messages regarding storm warnings issued for North Atlantic coast and eight a m barometric pressure and direction and velocity and state of weather at Highland Light Nantucket and Block Island and at five p m storm warnings and advices issued in afternoon

July 29—English—Portland Maine call letters NAB on sixteen hundred twenty meters spark broadcasts at noon wind and weather forecasts and storm warnings for Maine coast Eastport to Portsmouth advisory messages regarding storm warnings issued for North Atlantic coast and eight a m barometric pressure wind direction and velocity and state of weather at Portland and at eight p m storm warnings and advices issued in afternoon

July 30—English—radio amateur broadcast the following eight stations send out daily bulletins of Government news mostly agricultural market data Arlington Va Navy five nine five zero meters Great Lakes Ill Navy four nine zero zero meters Washington DC Post Office one nine eight zero meters Omaha Nebr Post Office two five zero zero meters North Platte Nebr Post Office four thousand meters Rock Springs Wyo Post Office three thousand meters Elko Nev Post Office three thousand meters Reno Nev Post Office thirty two hundred meters

July 31—English—Radio amateur broadcast recently in Cleveland O a father forty eight years of age and his son fifteen years of age were killed in a tragedy brought on when an aerial touched a twenty two hundred volt wire period In a hurry to set up a receiving set to hear a concert the son with the aid of another boy who was seriously burned had attached the aerial to the chimney of his house and in doing so threw it over a high tension wire period Not heeding the caution of other persons to tie a rope to the aerial the young man clutched it period In the meantime friction of the aerial had rubbed off the insulation of the electric wire a flash the youth was killed instantly and his father who rushed to save him died within a few minutes period This fatality should serve as a warning to others to be extremely careful in avoiding high tension wires and for that purpose this narrative is published

I-Want-To-Know

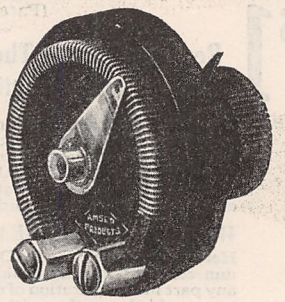
(*Continued from page 666*)

used a Beverage antenna in the transatlantic amateur tests. However, for all round amateur and broadcast work, the Beverage antenna will not be suitable due to its directional effects.

Q. 2. What type of loop will give good results?

A. 2. A loop wound on a frame 4' square with 10 turns of No. 18 wire spaced ½" apart will be satisfactory. A clip should be used to vary the number of turns.

AMSCO Improved RHEOSTAT



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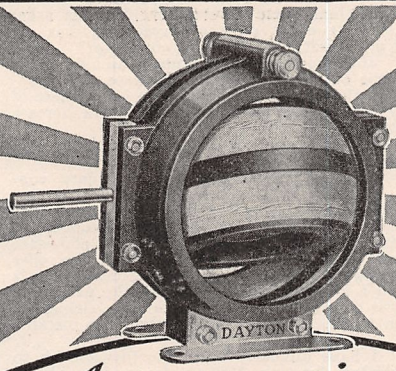

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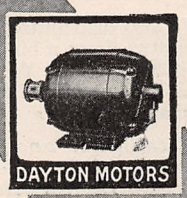

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CONDENSER

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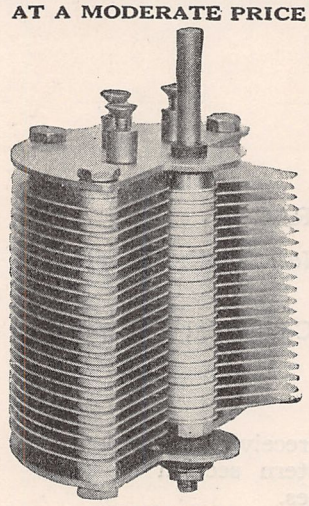

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MR. DEALER—Here is something that will interest you

Zimmerman Radio Co.

206 E. 12th Street NEW YORK

WAVELENGTH CONTROL

(493) Mr. John Teete of Petersburg, Virginia, asks:

Q. 1. What effect on the wavelength has an increase of capacity of the tuning condenser?

A. 1. If the condenser is in shunt to an inductance an increase of its capacity will increase the wavelength. In the standard radio circuits an increase of capacity in any of the tuning condensers will increase the wavelength.

Q. 2. When is the capacity of a variable condenser greatest?

A. 2. In the typical semi-circular plate condensers, the capacity is greatest when the movable plates are completely covered by the stationary plates. With a Connecticut or Crosley condenser, the greatest capacity is had when the two plates are as close to each other as possible. With the roller type of condenser, in which the movable element is wound on a spool or series of spools, the maximum capacity is obtained when all the movable element is rolled on to the spool containing the other metallic sheet.

Q. 3. I have difficulty in tuning low enough to receive the broadcasting. Will a series condenser help?

A. 3. A variable condenser in series with the antenna will enable you to reduce the wavelength of your set considerably.

DOUBLE AMPLIFICATION CIRCUIT

(494) Mr. F. Parsons, of Milwaukee, Wisconsin, asks:

Q. 1. Is the hookup in Fig. 374 of the "I-Want-To-Know" column of June suitable for efficient reception?

A. 1. The circuit you mention has never given satisfactory results for any length of time and we would not advise its use.

Q. 2. Would loud enough signals be brought in on such a set to operate a loud talker?

A. 2. We do not believe that you could efficiently operate a loud talker with this circuit, unless the transmitting station is in the immediate vicinity.

AMPLIFICATION WITH CRYSTAL DETECTOR

(495) Mr. O. Tracht of Columbus, Ohio, wants to know:

Q. 1. Please show a hookup with jacks for a one stage audio amplifier with either crystal or vacuum tube as detector.

A. 1. The circuit you desire is printed on these pages. We show a variometer set, though any type of tuner may be used.

Q. 2. Will the crystal and one step audio amplifier work satisfactorily?

A. 2. A crystal detector with a one stage audio amplifier will operate well, but will not be as efficient as the vacuum tube detector alone. If you wish to increase the receiving range of a crystal set, it would be well to employ the circuit illustrated in the "I-Want-To-Know" department for August.

COMMERCIAL VALUE OF STATIC ELIMINATOR

(496) Mr. V. House of Mishawaka, Indiana, asks:

Q. 1. Would an instrument to eliminate static be of any value, commercially?

A. 1. An instrument which would entirely eliminate static and not interfere with reception would have a very great commercial value.

Q. 2. What type of current is the static?

A. 2. Static and atmospheric disturbances are of both interrupted D.C. and D.C. character. The clicks heard in the phones are caused by D.C. impulses while the rumbling roar is caused by interrupted D.C. of varying frequency. Static is much more severe on long waves than on short waves.

EXPANSION OF RECEIVING SET

(497) Mr. P. Pittman of Rockford, Illinois, requests:

Q. 1. Please publish a hookup of an efficient receiving set for all around work, one which can be added to from time to time.

A. 1. A circuit such as you mention is published on this page. By making the tuner and detector in separate cabinets, it is possible to add either radio or audio amplification at will.

Q. 2. Please show how I may add a radio and audio amplifier to the set.

A. 2. The addition of the radio and audio amplifier is shown. You may arrange the binding posts on a rear sub-panel to eliminate unsightly wiring, if desired. A height of 9" for each panel will be found suitable.

LOOP MODULATION FOR PHONE

(498) Mr. C. H. Johnson of Galena Avenue, Freeport, L. I., writes:

Q. 1. May I use the enclosed diagram for C.W., I.C.W. and phone transmission?

A. 1. The hookup you enclosed is correct except for the position of the transmitting key. The key should be placed in the lead to the center tap of the filament or in series with the grid leak. The position in which you have it, the primary of the transformer, places too much strain upon the apparatus.

Q. 2. Will the loop modulation give good results?

A. 2. While the loop system of modulation will work, it is not as satisfactory as employing a separate modulation bulb or a modulation transformer in the grid circuit.

BEST HOOKUP FOR A LOOSE COUPLER

(499) Mr. Edwin Cummins of De Soto, Mo., wishes to know:

Q. 1. How may I hook up a loose coupler, two variable condensers, audio phones, etc., for best results?

A. 1. A circuit for such apparatus is connected in a manner which will allow efficient reception and is shown on this page.

Q. 2. Is there any method of eliminating the capacity effect of a tin roof adjacent to my aerial?

A. 2. The only effect the tin roof will have upon

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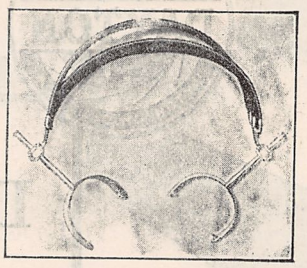
Manufacturers and dealers who require wireless apparatus or parts can obtain quantity output and guaranteed delivery. We have over half a million dollars invested in special and automatic machinery. Wire and metal products our specialty. Send sample your product and receive our quotation on making.



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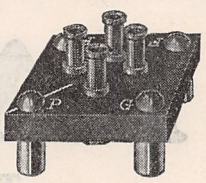
Plugs—Cat. No C-1 Price 25c
Jacks—Cat. No. C-100-200 Price 11c



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Murdock No. 56	3000 "	"	6.00
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7-strand cable construction copper aerial wire, per 100-ft. coil - - .65

See last month's Radio News for our Panel advertisement. What radio parts do you need for your set? Send enquiry for price and delivery. We have a large stock of the parts you know.

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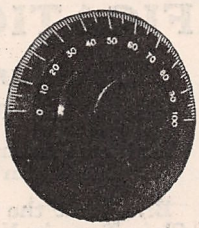

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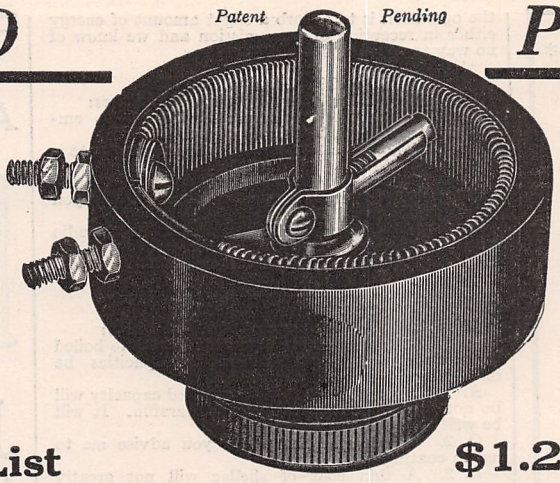

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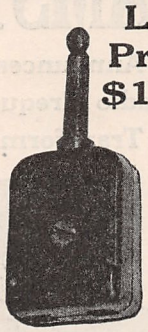

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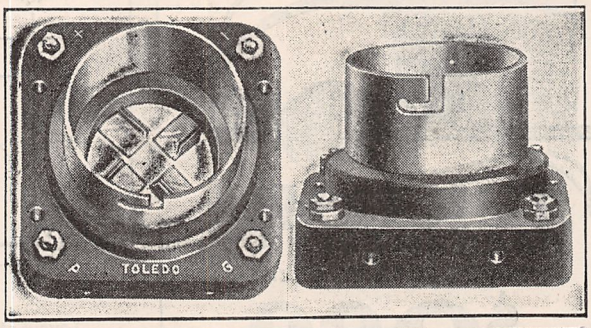

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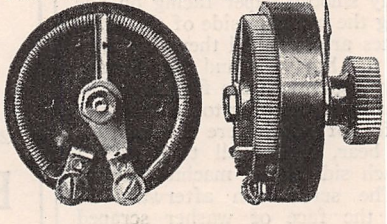
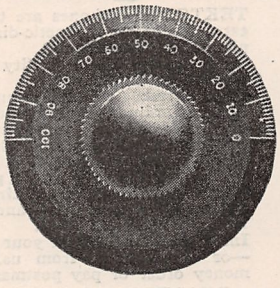


Our Nos. 700 and 701 dials and knobs (right) are of genuine black bakelite. Because of the ribbed construction of the dial it will not warp and being of bakelite it will not discolor. The threaded bushing in the dial which holds the knob is perfectly centered, as is the bushing in the knob itself which takes the shaft. This insures a perfect running dial. The bakelite knob is fastened to the dial by means of a threaded bushing. The set screw which secures the knob and dial passes through the composition and also the brass bushing, thus preventing loosening. Either 3/16" or ¼" knob and dial, $1. Shipping weight, 4 ounces.



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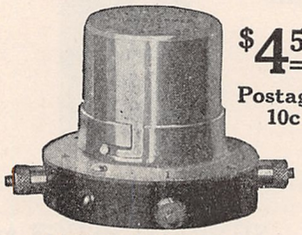
Announces a Radio Frequency Transformer



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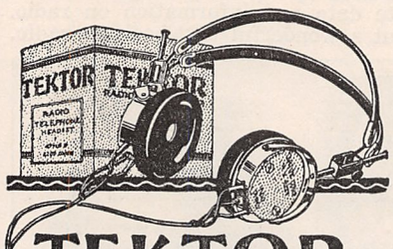

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the operation is to absorb a slight amount of energy either in reception or transmission and we know of no way to avoid this loss.

AERIOTRON AMPLIFIER

(500) Mr. H. Brubaker, Ephrata, Pa., writes:

Q. 1. What size potentiometer should be employed across the A battery in a receiving set?

A. 1. The general value of the shunt resistance is around 200 ohms.

Q. 2. I have an Aeriotron bulb and would like to employ a few more in an audio amplifier, will you please publish such a circuit?

A. 2. You may use Aeriotron tubes in an audio amplifier with good results. Follow out any of the diagrams already printed in this magazine for a two stage amplifier.

COATING FOR COILS

(501) Mr. Troy of Elmira, New York, asks:

Q. 1. If spiderweb or honeycomb coils are boiled in paraffin will their distributed capacities be materially increased?

A. 1. A large increase in distributed capacity will be noted if the coils are boiled in paraffin. It will be well to avoid such a procedure.

Q. 2. Which material would you advise me to use in coating coils?

A. 2. A thin coat of shellac will not greatly affect the distributed capacity and will prevent shortage and leakage from moist insulation. Some manufacturers of honeycomb or duolateral coils dip the completed coils in a thin solution of some insulating material and then rapidly spin the coils. In this manner all the excess material is cast off and the distributed capacity is kept low.

Practical Home-Made Condensers

(*Continued from page* 655)

The next step is that of making the fixed plates for the rotating vernier condenser unit. These are cut from the fibre sheet to dimensions shown in Fig. 5.

After cutting, cover the ends of each with tinfoil, leaving an open space of 1½" in the center. The tinfoil can be held in position by immersing the fibre plate in hot wax and laying on the foil before it cools, smoothing down as the wax sets.

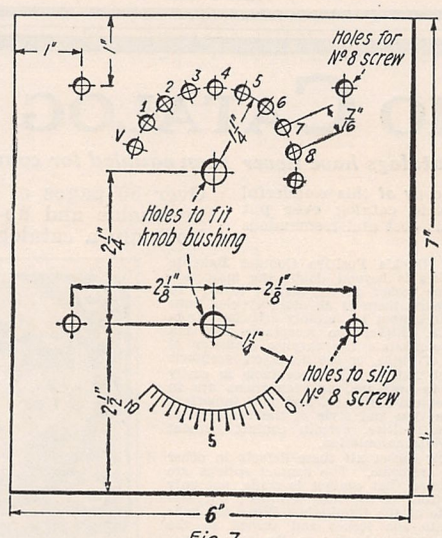


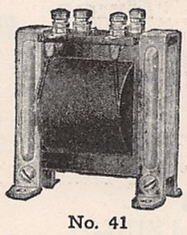
Fig. 7

Layout of the Front Panel Supporting the Whole Unit.

Then cover the entire plate, excepting two ½" lengths at the ends, with a single layer of good grade writing paper. Here again the gummed flap of an envelope will be found convenient. Care must be used to get a perfectly smooth paper facing on one side, this being the working side of the plate. When all plates are mounted they should be immersed in the hot wax and the surface smoothed down tight with the fingers as the wax cools and sets. In order to avoid having to clean the foil of wax where the connecting washers bear, it is well to fasten a washer on each side, using machine screws and nuts. The screw can afterward be removed and the face of washer scraped free of wax.

This completes the parts on which hot wax is required and the next step is to make the rotating plate.

"SUPERLATIVE" AMPLIFICATION



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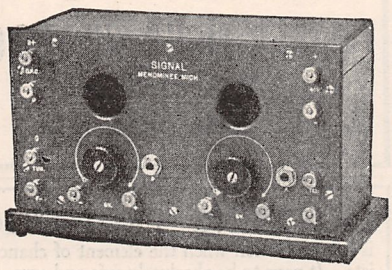

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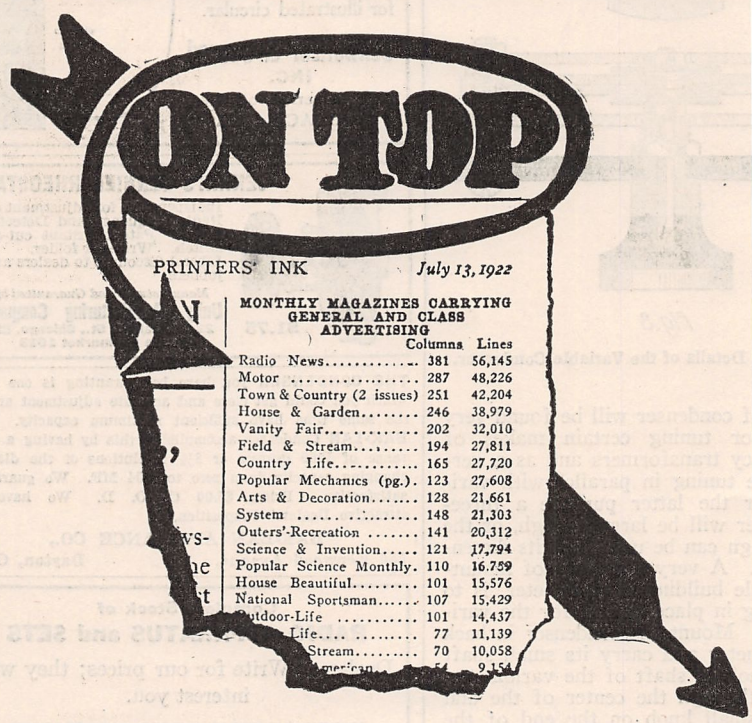

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This plate is to be carefully cut from a piece of 1/64″ hard sheet brass, and it must not be allowed to buckle or bend. The shape and dimensions are shown in Fig. 6a. After cutting, all the edges should be carefully rounded with a fine file and emery paper. While working this sheet brass the other members should also be cut and finished. Fig. 6b shows the contact plate for the dial. The slots are to be laid out on the same centers as the contact buttons and then cut with a fine-tooth hack saw. It will be found convenient to clamp this piece to a thin piece of wood and clamp both together in the vice when sawing, making the cuts by forward movements only. All edges of this plate should be neatly smoothed up and the ends of each saw cut champhered with a fine file in order that they will ride easily over the corners of the buttons when the dial is turned. The face of the dial should be carefully polished and it can be nickel plated for a few cents.

The third piece of sheet brass, as shown in Fig. 6c, is the strap that connects the dial bushing with the condenser shaft bushing, being placed back of the panel and under the nuts that hold the bushings in place.

The details of assembling this rotating vernier condenser are shown in plan and section by Fig. 8.

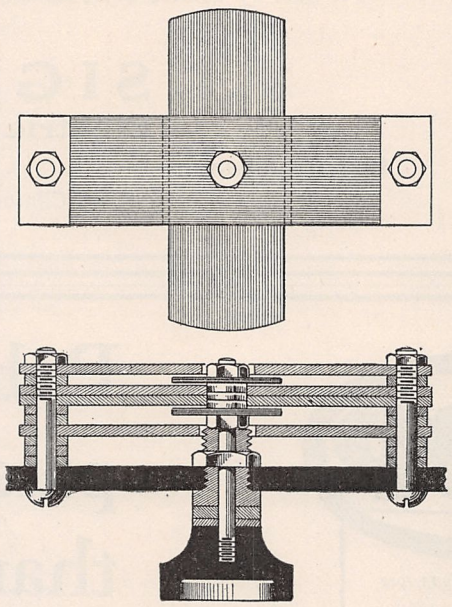

Fig. 8

Constructional Details of the Variable Condenser.

This type of condenser will be found very practicable for tuning certain makes of radio frequency transformers and as a vernier for close tuning in parallel with variometers. For the latter purpose a three-plate condenser will be large enough, or the five-plate design can be used, and its dimensions reduced. A very neat way of mounting these while building a variometer, is to use ¼″ tubing in place of rod for the variometer shaft. Mount the condenser in back of the variometer and carry its small shaft through the hollow shaft of the variometer. Bore a hole through the center of the dial and place a small knob on the end of the condenser shaft. This takes no extra room on the panel and places the condenser knob in a handy location in relation to its accompanying variometer dial.

The last piece to make is the panel for assembling the entire unit. This is 6″ by 7″, or a convenient size for the units of a set built on this principle. The drilling is laid out in detail in Fig. 7. This panel is, of course, not required when the unit is mounted on the same panel as other apparatus.

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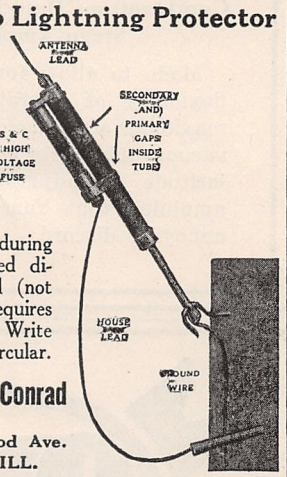

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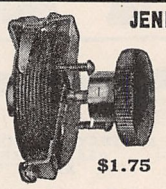

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The scale for the condenser pointer is scribed on the panel with a pair of dividers and a scratch awl guided by a straightedge. This should be done before boring the shaft hole in the panel, using the punch mark as a center for scribing. If it is possible to borrow a set of steel figures and letters these can be punched in the dial to make it look like a real factory job. If not they can be put on with "white ink," as used by draughtsmen.

The complete assembly is shown in detail in Fig. 9 and is largely self explanatory. The eight fixed condenser units are held in position by the connecting wires, which are stiff enough for this purpose. The wire from one binding post connects one end of each fixed condenser and both ends of the fixed plates of the variable condenser. The other end of each fixed unit connects to its corresponding dial button. Note that the first button is not used, being a support for the first blade of the dial when it is in position for using the vernier only.

In mounting the plates for the vernier they should be so spaced that the movable vanes will just touch the paper covering the foil. If too tight, the friction will wear the paper and short the unit. If spaced too far the capacity will be less than each of the fixed units. The movable vanes should be fixed to the shaft with a drop of solder as well as being held by the nuts on the shaft. This soldering should be done as each plate is assembled using a well tinned soldering iron at proper heat.

Using this idea for condensers the size and capacity of the unit can be varied to almost any extent and thereby fill all condenser requirements at very moderate cost.

In using the condenser for smooth continuous tuning the vernier dial must be turned back to zero each time the contact dial is moved one point. With a little practice this will be found just as handy and almost as smooth as that of a continuous condenser.

In case it is desired to mount on a panel with other apparatus, where space is limited, one can modify this design by making the condenser shaft of ¼" tubing, using a dial for turning it. The dial switch and fixed units can then be mounted back of the rotating unit, with the dial shaft passing through the hollow shaft of this, similar to the method described for mounting with variometers.

The Use of Power Tubes in Radio Reception

(*Continued from page* 631)

ting, and he did not want to transmit. He could not be blamed for this opinion, because the average radio dealer sells vacuum tubes according to the above classification, and when asked for a detector tube, he almost invariably supplies the gaseous content detector tube.

The use of the gaseous content detector tube began with the early models of vacuum tubes when it was hardly possible to pump a tube sufficiently to get what is nowadays called a hard tube. As a matter of fact, the classification of vacuum tubes today, instead of being called detector, amplifier, and power tubes, should be rated as soft, medium, and hard tubes. With the customary use of the grid condenser and grid leak, practically all the modern receiving sets can use the hard tubes as detectors or amplifiers, or both. Though the gaseous content tube cannot be used for high amplification, or transmitting, the opposite is possible, that is, the hard or so-called transmitting power tube is an excellent detector and amplifier, and has a very real use in the saving of equipment in the modern radio station. Primarily, the soft detector tube was developed to its present point of efficiency by the demands of amateurs for a super-sensitive tube which under critical adjustment would

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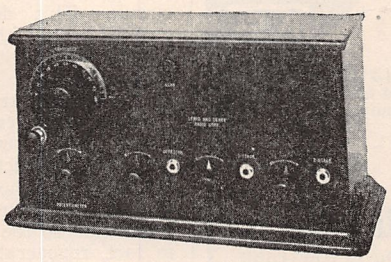

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7—Transformers: designed for maximum amplification WITHOUT DISTORTION; mechanically and electrically perfect.

8—Wire: square tinned copper, bus-bar type.

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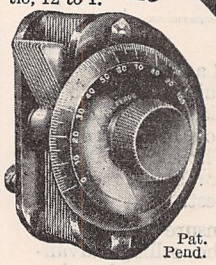

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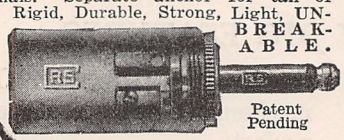

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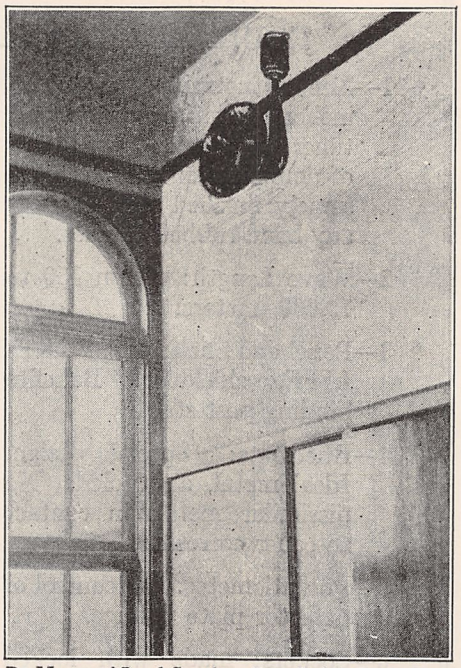
give an extended range to their receiving sets. By this, it is meant that extremely faint signals, or even those which could not be heard at all, could, by means of the use of a soft tube very carefully adjusted, be heard with sufficient audibility to be read in a pair of ear phones. This increased sensibility was added to enormously by the use of regeneration by means of the Armstrong circuit. This development, however, occurred before the advent of the modern broadcasting station. Regeneration to the maximum, while increasing the sensitiveness of the tube, destroyed the tone of the signal received. However, as this was usually a spark signal, sent out in the telegraphic code, the destruction of the normal tone of the signal was not harmful to reception. In the reception of radiophone broadcasting, regeneration to the maximum is not possible; in fact, regeneration cannot be carried anywhere near the maximum point without extreme distortion, and jumpiness of the speech or music. By jumpiness, it is meant that a loud signal will cause a greater response than a weak impulse, so that when a person is singing, the heavier notes come out twice or three times as loud as they should, while the weaker notes retain their normal volume. This, of course, spoils the music and the effect may be, most of the time, laid to



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a critically adjusted soft tube used as a detector, with maximum, or nearly maximum regeneration.

This distortion of music and speech can be almost entirely eliminated by the use of a hard or transmitting tube as a detector. The five-watt power tubes now on the market, such as the Radiotron, type 302; Cunningham, type 202; Moorhead, or AP, type TT transmitter; the Western Electric, VT2, available through sales by the U. S. Army, and the GE Gold Tip, Navy type, released by the U. S. Navy—all of them are excellent detectors, oscillators, regenerators, and amplifiers, when used in almost any standard radio receiving set or circuit. Perhaps they are not quite as sensitive for 2,000 mile spark reception as the gaseous type. They have sufficient sensitiveness to do as good work as the gaseous content type in the hands of the uninitiated as far as range is concerned, but they are far better in their rectifying properties in that they do not distort the received music and speech nearly as much.

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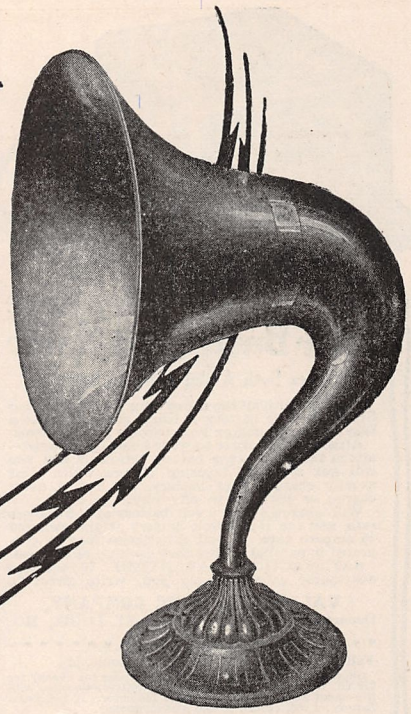
substituted for his present detector tube will greatly add to his volume. In fact, a single tube set, using a power tube connected to a Magnavox, has received wireless speech and music audible 25′ from the Magnavox horn, over 800 miles from the broadcasting station. While this is exceptional, a great increase in volume is always obtainable by the use of a power tube as a detector. With a single tube, for instance, a Cunningham or Radiotron five-watt transmitter, it is possible within 10 or 15 miles of a broadcasting station to use a Magnavox or other loud speaker, although the resultant volume will not be as great as might be desired. To do this, it is necessary to use 300 to 500 volts on the plates, cut out the plate battery potentiometer, and use as much regeneration as possible without distorting the received signals. The use of 300 volts on receiving set of this sort does not harm the receiving set because it does not pass through any transformer or other coils, but care must be taken that the loud speaker used will be able to stand the voltage. The Magnavox, of course, will not be harmed, Several other loud speakers can be used, but loud speakers made from phones attached to a horn are not safe with this arrangement because the windings are liable to be burned out. It is, however, practical to use with this method, a loud speaker made from a 70-ohm phone used in conjunction with a stepdown coil; the primary winding of this coil then takes the steady plate current of the tube and protects the receiver. A power tube may still be used without the use of such high voltages. One of the beautiful features about the use of the power tube as a detector is that it is on the job without critical adjustment, either for "A" battery or "B" battery. In other words, a power tube will work very nicely with 75 volts or 100 volts, it will work much better with 200 volts, and it will work at its maximum efficiency with 350 volts, if that is its rated capacity. A loud speaker made from phones and a horn may be used with 100 volts on the plates, providing care is taken that the polarity of the receiver is currect so that the steady plate current through the telephone receiver does not de-polarize the permanent magnets obtained therein.

The use of the power tube in this matter as a detector is a revelation. It will oscillate fully as freely as a soft tube; it will regenerate fully as well and yet is not fussy in regard to its plate potential or in general its filament adjustment. It gives far better rectification, does not distort as much, and all round is more satisfactory for use by the person who is none too familiar with radio adjustments, than is the soft tube.

However, there are many people who have more than just a vacuum tube detector; in addition, they usually have a two-stage amplifier. In this case three power tubes may be used to the best advantage, one as a detector and two as amplifiers. There are several things, however, to be taken into consideration when using equipment of this sort. In the first place the output of the detector tube must go through an amplifying transformer to get to the grid of the second tube. Again, the output of the first amplifying tube must go through another amplifying transformer before it gets to the output of the final tube. There are a number of combinations of "B" battery potentials which may be used for the purpose of supplying these power tubes, but always it must be borne in mind that the primary of the amplifying transformer must not be overloaded so that they will burn out. Even though the tubes themselves may be able to carry the high plate voltage, the average amplifying transformer that is on the market today will not stand much over 150 volts in continuous operation; therefore, we must limit the amount of plate voltage which we use on the detector and which we use on the first amplifying tube. We may use 100 volts on the detector tube and 150 volts

Get This—



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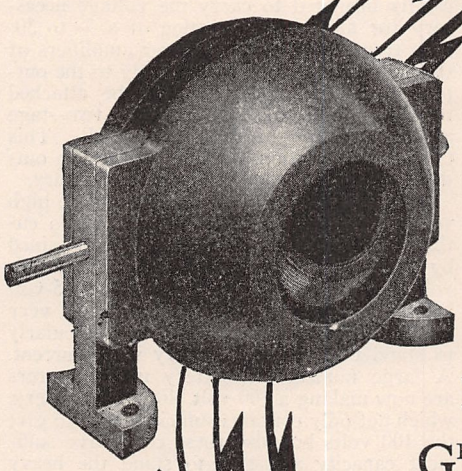

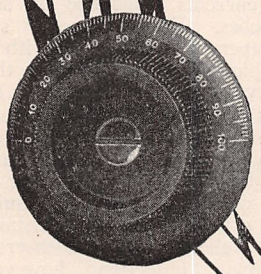

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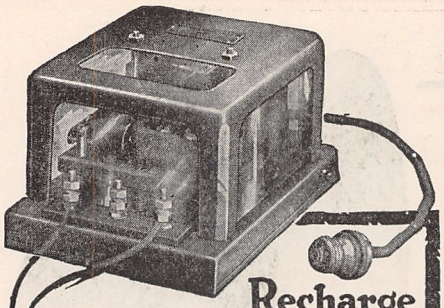

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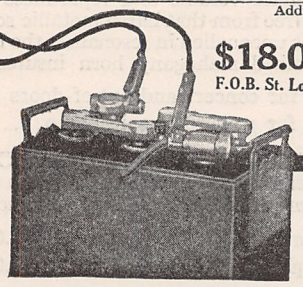

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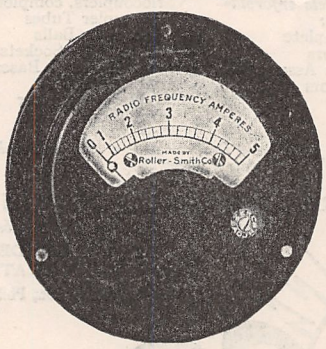

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on the two amplifier tubes; however, the last tube of the amplifier is connected directly to the loud speaker and does not have to go through the amplifying transformer. If a Magnavox is used, as high as 500 volts may be used on the last stage, providing the tube will stand it. The first stage and the detector may use 100 volts each, and in this way, by carefully selecting the "B" battery voltage and putting in power tubes, the output of a detector and two-stage amplifier receiving set may be enormously increased, and this increase in output may be just enough to bring up the music and speech where it is a pleasure rather than a strain to listen to it. This use of power tubes in the reception of radio telephone broadcasting should be earnestly looked into, particularly when the receiving set is at such a distance from the broadcasting station that the received music is hardly loud enough to be eminently satisfactory. When greater amplification is desired, it is necessary to use a power amplifier and a loud speaking reproducer that will stand a heavy current. The main difference between a power amplifier and any other amplifier is that it contains amplifying transformers which are sufficiently insulated to carry the voltage necessary for maximum operation of a 5- to 30-watt transmitting tube. Power amplifiers of this sort may be attached directly to the output of a detector set or may be attached to the output of an ordinary two-stage amplifier, making four stages in all. This type of installation is more suited for outdoor use where great volume is necessary.

In all of the above discussions where high voltage is mentioned, the average radio enthusiast thinks that this should be obtained by the use of the common and popular 45-volt "B" battery in series. These 45-volt batteries, however, are made up of very small cells and are not designed particularly to stand the drag of a heavy plate current. A large number of battery manufacturers are now making a 100-volt block "B" battery, which not only contains sufficient cells to give the 100 volts but also these cells have sufficient capacity and size to stand the heavy plate currents demanded by such voltages and tubes. From a money standpoint, it is cheaper to buy for use with power tubes these block batteries, because they will outlast several sets of the smaller types.

It is also possible under certain conditions to use a motor generator set to supply the plate voltage for power tubes used in reception. Just as in a transmitting set, the hum of the commutator may be eliminated by the use of a filter system comprising a combination of chokes and condensers. There is one main objection, however, to the use of a motor generator for an amplifier in radio and that is the taking place, as the armature rotates, of a very minute sparking as each commutator segment leaves the brush. The commutator sparking gives off a more or less periodic radio wave which is picked up by the detector tube and amplified through the amplifier into a disagreeable buzz. This cannot be eliminated by the use of choke coils or condensers, but may be eliminated by a careful screening of the generator. This screen is then grounded. In some cases a screening of the generator leads is also necessary, but if the generator is carefully screened and grounded, the buzzing is eliminated. As a matter of fact, for outdoor use a slight hum is not objectionable and cannot be heard at more than a few feet away from the horn. The amplification, of course, can only be carried to the limit of the tube in the last stage of amplification. In other words, if music and speech are being reproduced with as much volume as the last tube can stand it will do no good to add another stage, using the same type of tube. It is, however, possible to still further increase the volume by adding another tube of a different type; for instance, a set may consist of a detector and two amplifier tubes

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of the five-watt type. A third stage may be added then, consisting of a 50-watt tube, and in these cases, it is almost always necessary to use a motor generator, at least for the last stage.

A set of the above type, using enormous amplification, if carefully constructed, will not distort any more than an ordinary two-stage amplifier set. A set of this kind will also have other uses than simply creating a greater volume of sound through one or two reproducers. Such a set will solve the problem of the apartment house where it is desired to use a radio set in each apartment.

To install a separate radio receiving set in each apartment would necessitate an enormous duplication of equipment. How much easier it would be to install a good receiving set on the roof, use power amplification, and have a reproducer only in each apartment. These reproducers, each of them, could be supplied with a switch to cut in the reproducer, and in this way each apartment could listen to the concerts; this is by no means a dream.

Several times during the last few years, the editor of this magazine, Mr. Gernsback, has prophesied and illustrated with drawings, installations of this type. It is with the greatest pleasure that the writer presents herewith photographs of an installation more or less approaching this in its results. This installation, designed and installed by a large western manufacturer of electrodynamic reproducers and power amplifiers, is not only unique but amply illustrates what can be done at present with modern radio equipment. While the installation is not in an apartment house, it is in a school containing 27 rooms. In each room there is an electrodynamic reproducer set in the corner where the voice or music can reach all the pupils distinctly. (This is shown clearly in Fig. 1.) In the principal's office, built into the wall beside his desk, is a power amplifier cabinet and a selector panel. (This cabinet and panel are shown in Fig. 2.) All 27 reproducers are controlled from the panel as is also the motor generator, which supplies all the current for this panel. Each one, or any number of the reproducers may be separately energized or, by means of a master switch, all of the reproducers may be put in circuit. A transmitter is then used so that the principal may talk to each, any or all rooms. This, however, is not the only feature of this installation, but there is, in another part of the school, the highest type of radio receiving set obtainable, installed by another concern. The output of this radio receiving set is wired directly into the power amplifier cabinet and by means of a switch, the radio music and speech may be turned loose in any one of the 27 rooms, just exactly the same way as the principal's voice itself. The complete outfit, consisting of the radio receiving set, power amplifier cabinet, selector panel, and motor generator set, as well as the 27 reproducers, taken all together, are not so expensive but what a modern high-class apartment house could afford to install the same type of outfit. The selector panel, instead of being at one point could easily be split up so that each reproducer at its particular location could be energized by the occupant of the apartment. In this way, radio would be available for everybody in the building and there are several high-class apartment houses now building which will contain radio installations.

To sum up, it may be said that a transmitting tube, while more or less misnamed, is very important in radio reception and by its use and the addition of a little "B" battery, increases in volume without increases of distortion may be obtained from receiving sets which are now thought to be working at their maximum volume. It is to be hoped that the use of power tubes in this connection will become more general because the use of them consistently in radio receiving sets will save one complete stage of amplification in a large number of cases

Give Your Radio Set the Advantage of

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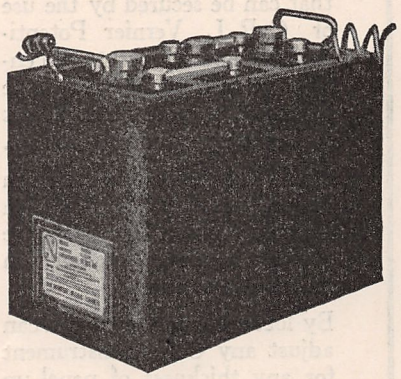

Westinghouse "A" Batteries are especially built for the peculiar requirements of radio work. They deliver a constant, dependable flow of low voltage current. They are built to give long, low-cost service. They demand a minimum of attention.

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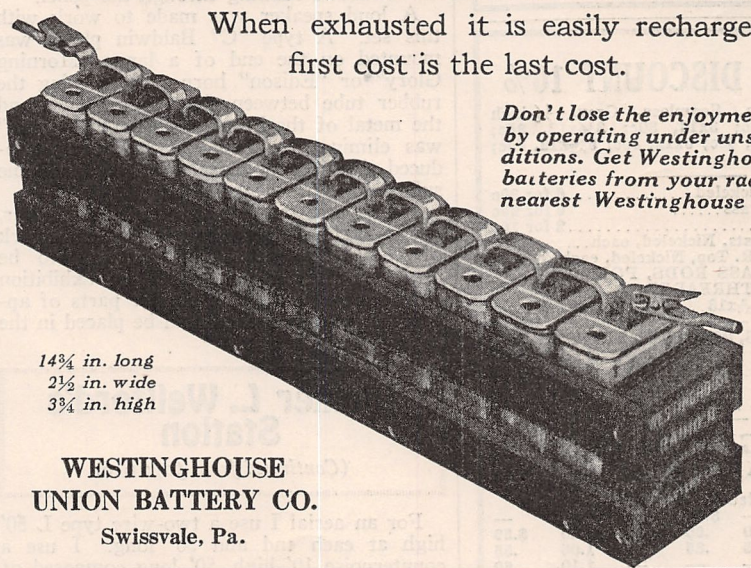

14¾ in. long
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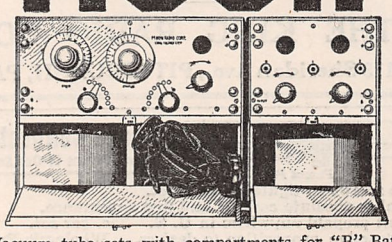

Vacuum tube sets with compartments for "B" Batteries and Phones. Write for Catalogue and Prices.

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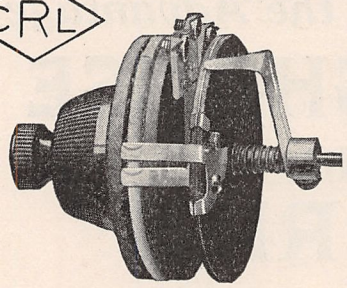

THE FINER ADJUSTMENTS

that can be secured by the use of C R L Vernier Potentiometers and Rheostats will enable you to obtain that accurate tuning that you need to get real enjoyment out of your set.

You'll like the noiseless, smooth action that the C R L design insures. Each turn of the resistor is firmly anchored in its correct position.

By loosening one screw you can adjust any C R L instrument for any thickness of panel up to ½ inch.

Use C R L Potentiometers and Rheostats of both the plain and vernier types.

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Cardboard Tubes, Seamless, Gray, ⅛-inch wall, 2½x12, 25c; 3x12, 30c; 3½x12, 35c; 4x12, 40c; 4½x12, 45c; 5x12, 50c; 5½x12, 55c; 6x12, 60c.

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No. 20	$.60	$.30	.80	$.40	$1.00	$.50
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No. 24	.70	.40	.90	.50	1.10	.60
No. 26	.75	.45	.95	.55	1.15	.65
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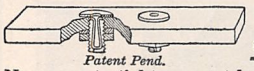

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and in that way will more than pay for their installation. Not the least important feature of the use of power tubes is their ease of adjustment. They do not block, and they do not hiss, and are much quieter in operation than the soft tube. One prominent radio manufacturer in his instruction sheet is recommending their use throughout the radio set, and it is only necessary to try them out properly to be satisfied that they are an enormous help for good radiophone speech and music reception.

Raymond Whitcomb's Station 7AAR

(*Continued from page 646*)

Navy tubes are used. A Navy headset, type C-W 834, is also used, and a Navy triple crystal set, Type SE 183-A, is available for testing. A new C-W transmitter and phone set is now in the course of construction and will employ four Navy transmitting tubes, type C-W 931 in a Heising-Colpitt's circuit. At present 7AAR is not transmitting.

A Compact Radio Receiving Set

(*Continued from page 652*)

mounted all the parts of the tuner, the panel being fastened to the front edge with flat head wood screws. The width of the board can be varied; the one used in this set was 8" wide, and gave room along the back to place the blocks of "B" batteries. The upper board is about 4" wide, and mounts about 5" from the top of the panel. All the parts of the detector and amplifier are on this board. Like the base board, it is mounted with flat headed wood screws running through the panel.

A loud speaker was made to work with this set. A type "C" Baldwin phone was mounted on the end of a large "Morning Glory" or "Edison" horn. By keeping the rubber tube between the receiver case and the metal of the horn, much of the "grind" was eliminated. This loud speaker reproduced signals very clearly, and with volume sufficient to be heard a city block.

A case was made to contain this receiver, and was finished to match the woodwork of the office where the set was to be used. If the set is intended for exhibition purposes, or for selling similar parts of apparatus, a glass back should be placed in the apparatus.

Walker L. Wellford's Station

(*Continued from page 646*)

For an aerial I use a two-wire type L 50′ high at each end and 50′ long. I use a counterpoise 10′ high, 50′ long composed of five wires.

WALKER L. WELLFORD, JR.
205 So. Belvedere Blvd., Memphis, Tenn.

A Paper-pulp Loud-speaker Horn

(*Continued from page 648*)

may then be held against the block by heavy rubber bands.

A stand should be made to hold the horn in the proper position. The best way to finish the surface is to paint it with shellac mixed with lamp black. This gives the horn a glossy black appearance which makes it look very well. The paper pulp will have a rough surface which could not be made smooth without a great deal of work, but

Amplifying CUSHIONS

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The Tone Chamber Does It

Catches every sound wave from the receiver diaphram and megaphones it to the sensitive part of the ear.

The soft rubber cushions exclude room noises yet comfort and ventilate the ears.

Easily installed in two minutes by anyone.

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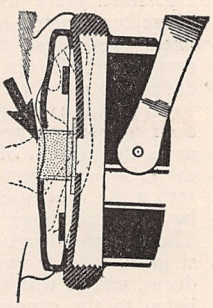
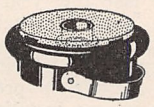


ONE DOLLAR



Mention make of your phones

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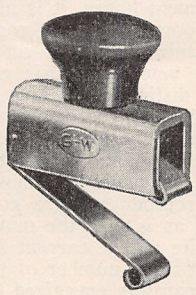

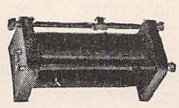

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this looks very well if finished as recommended here.

A horn of this kind, provided with a Baldwin Type C receiver, makes a very good loud speaker, and will give just as good satisfaction as expensive ones. The cost of the material used in making this horn is practically negligible. The only cost is the time required. The satisfaction of possessing a loud speaker made by oneself will more than repay for the time consumed.

How to Wire a Radio Set Correctly

(*Continued from page* 654)

ing makes soldering simpler. Excessive heat will burn it off, so that once it has been applied, care should be taken to regulate the heat.

After both surfaces have been cleaned, flux sparingly applied, and the iron heated, the work may begin. Holding the iron in one hand, melt about an eighth of an inch of wire solder on the tip of the iron and apply the iron to the two parts to be joined. The solder should flow freely to the two surfaces and connect the two parts. If it does not, either the iron is too cold, not enough melted solder is available to flow downward, or the iron is not being held right. If the solder flows, but does not join the parts or adhere to them, the surfaces may be dirty, or not enough flux applied to them.

In inaccessible places, or delicate work, it is sometimes impossible to solder a joint directly. If this is the case, apply solder to each part in turn, and then, pressing them together with pliers, hold the iron against the metal so that the solder applied will again be melted, and the joint sweated together.

This method will be found especially useful at first, when learning the art, and it produces better results than the usual method, although it takes more time.

When first planning the wiring of a set it is sometimes best to make a drawing of it, showing the wiring. With this can be seen the wires which cross each other, and plans may be laid for connections, which have the least possible number of crossings. In wiring two-step amplifiers and such apparatus where induced currents are a factor of inefficiency, especially tube apparatus, care should be taken not to have wires running parallel to each other for any appreciable distance. Well planned wiring pays in the long run.

In wiring transmitters, try always to keep power and radio-frequency circuits separate, as far as possible. In amplifying circuits, keep the wiring of the primary of the amplifying transformer separate and at right angles to the wiring of the secondary. Keep grid circuit wires short.

In the small sets where good wiring shows up best, try to make all bends at right angles, and have all lengths of wire on either a horizontal or vertical plane. This gives an orderly appearance to the apparatus.

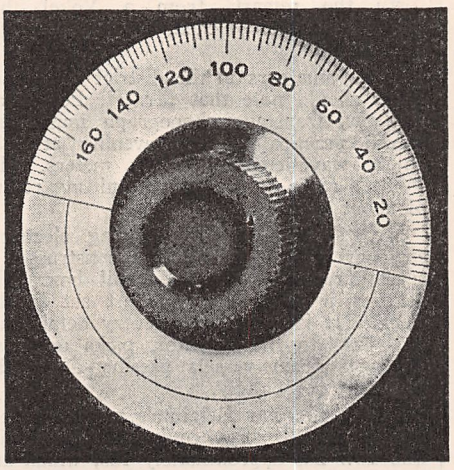
Contributed by SHELDON TRENT.

Radio Notes Gathered at London, England

By C. L. WHITNEY

THE Postmaster-General's scheme for wireless broadcasting by private enterprise has been considered by the Federation of British Industries, who suggest that only British-made apparatus should be used for receiving sets.

"Punch" recently published a very amusing "wireless" cartoon. An aeroplane, tearing along in a cloud of smoke and flame



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SPECIFICATIONS—Bakelite knob, with concealed set screw and heavy brass bearing for ¼-in. or 3/16-in. shafts. Dial of brass, heavily silver plated and lacquered, diameter, 3¼-in.

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Westinghouse 1½v. Peanut Tube	$8.00
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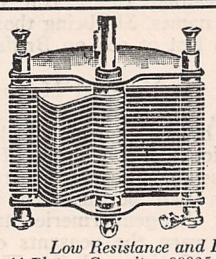

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and heading for certain destruction, brought forth the remark from a Yokel that "There's another of them wireless messages caught fire."

Radio amateurs in the district of Broadstairs should note that Mr. H. Pound, an amateur, transmits phonograph music and speech practically every evening at 9:30 on a wave-length of 440 meters. Mr. Pound's radio set has a transmitting radius of about 19 miles.

Mr. T. F. Rendall, a young electrical engineer of Sunderland, has constructed a crystal receiving set in a pill box. He believes it to be the smallest set in the world. It is complete in every detail and, according to the inventor, picks up clear messages from vessels passing along the northeast coast daily.

Before the war Belgium's merchant fleet had about 10 ships equipped with radio. She now has approximately 120, which are under the control of the Administration des Télègraphes.

A station with a range of a thousand kilometers is being erected near Prague, to deal with aeroplane service between Prague and Warsaw. Two stations are to be built in Bohemia for ærial navigation purposes also.

The Central Telegraph Office (London) has established radio communication with Berlin, Cologne, Posen, Rome, and Egypt, through the Post Office Radio Station at Leafield (GBL) near Oxford. Signals from this station have been heard in India and Australia. This station also maintains a regular service for press reports with Halifax (HX) on a wave-length of 8750 meters.

In the 1921 report of Mr. H. Kershaw, H. M. Commercial Secretary at Stockholm, on the economic commercial and industrial situation in Sweden, he states that serious consideration is being given to the possibility of practical use of the wireless phone, and that during the summer exhibition in Lulea, communication by radiophone was carried on between that city and Boden. Experiments were also carried out earlier in the year with the object of examining the possibilities of utilizing high-frequency power cables for communication via the wired-wireless which was invented by General Squier of the American Army.

The business men of Tokio and Osaka, Japan, finding that the telephone lines between the two cities are very congested at certain hours during the day, have decided to use radiophones, with Nagoya as a relay station. Their application has been placed with the Department of Communications for permission to establish this service, by the representative of the Daido Electric Motor Power Co., one of the chief promoters of the scheme.

Wireless Operators "stood bi" at noon on June 29 to hear the Last Post and Reveille sounded via radiophone by six bugler-boys at the Marconi House, London on the occasion of the unveiling of a roll of honor containing 348 names, 316 being those of wireless operators lost at sea on British vessels.

Rumor has it that the National Meteorological Office, Paris, will send twice daily a weather forecast by radiophone to the French rural districts. Probably Eiffel Tower will be used as the transmitting station. Receiving sets will be installed in parish schools or at the gendarmerie stations, and they will warn the peasants of impending storms by ringing a bell. The receiving sets will cost not over 200 francs or about $18.

All have heard of the work that the famous St. Bernard dogs of the Alpine monasteries have done in rescuing mountaineers. At the Vollot Observatory, on the peak of Mount Blanc, a wireless station has been erected specially equipped to resist the sudden atmospheric changes that

Ford Runs 57 Miles on Gallon of Gasoline

A new automatic Vaporizer and Decarbonizer, which in actual test has increased the power and mileage of Fords from 25 to 50 per cent and at the same time removed every particle of carbon from the cylinders, is the proud achievement of John A. Stransky, 521 South Main Street, Pukwana, South Dakota. A remarkable feature of this simple and inexpensive device is that its action is governed entirely by the motor. It is slipped between the carburetor and intake manifold and can be installed by anyone in five minutes without drilling or tapping. With it attached, Ford cars have made from 40 to 57 miles on one gallon of gasoline. Mr. Stransky wants to place a few of these devices on cars in this territory and has a very liberal offer to make to anyone who is able to handle the business which is sure to be created wherever this marvelous little device is demonstrated. If you want to try one entirely at his risk send him your name and address today.—Adv.

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"Why Many Men are Old at Forty" may bring a priceless message to you. It tells of a simple, sensible way by which thousands have corrected this prostate gland condition. It tells how sciatica, backaches, foot pains, interrupted sleep, mental depression, etc., are so often due to this gland. Sold for over five years upon a money-back-if not-satisfied plan. Do not confuse it with massage, medication, violet rays, etc. No obligation.

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Make this the most profitable and enjoyable summer of your life. Come to Chicago, the electrical center and the country's greatest summer resort city. Learn Electricity in America's oldest, largest and best equipped school. Earn your way, free employment dept.

FREE R. R. FARE If you come now we will pay your railroad fare and give you *free* a course in auto truck and tractor electricity, a course in radio, and a life sholarship in the great Coyne School. This is the greatest offer ever made by a school. Write at once for particulars as we cannot keep this offer open long.

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---and better results assured. Such advantages are easily possible with this compact, practical precision machine for working in bakelite, formica, brass, copper, carbon, wood, etc.

The Boice Pony Bench Machine combines bench saw, disc sander, drill, buffer, grinder and polisher. Especially adapted to rapid and accurate production of small duplicate parts. All metal. Saws up to 1 1-2 in. stock. Easily driven from line shaft or with 1-4 hp. or 1-3 hp. motor. **Special Offer** Machine with wood saw, grinding and buffing wheels and sand disc $37.85. Same machine and equipment mounted on metal base with 1-3 hp. ball bearing motor $73.00. Write for circular.

SOLD ON MONEY-BACK GUARANTEE
W. B. & J. E. BOICE - Dept. 710 - 114 23rd St., Toledo, Ohio

usually put ordinary apparatus out of commission. Climbing parties are now warned to equip themselves with radio apparatus before setting out on a climb, so that help can be called for from the Observatory in case of emergency; SOS in another role.

One of the most famous wireless stations in Europe, at Poldhu, Wales has closed down for traffic. MPD will no longer be heard by ships at sea. Clifden, Marconi's Irish station, takes Poldhu's place and handles the news broadcasted each night at 1 A. M. on a wave of 5750 meters spark. Poldhu is perched on a rocky coast of Cornwall and was the first high-power station ever built, and it was from there that the first wireless message was flashed across the Atlantic. A 2,000-meter wave-length was used at that time, and the message was received at St. Johns, Newfoundland, on November 12, 1901. Poldhu will henceforth be used as a research station by the Marconi company. Poldhu's regular traffic to Paris, Madrid, and Berne, is now being handled by a new station using C.W. which is located at Ongar, 20 miles from the Radio House, Finsbury Square, London, where the traffic is sent from by remote control.

Every afternoon excepting Saturday and Sunday, the radiophone station at Eiffel Tower, Paris, transmits speech (in French) and music on a 2,600-meter wave-length which is not very sharply tuned. The transmissions commence at approximately 5 P. M., summer time, and are followed at 6 P. M., by weather forecasts in French. Special transmissions are fairly frequent from FL and as a rule, notice is given of these special concerts during the regular daily program.

The Marconi company's concerts from Writtle may be heard every Tuesday evening beginning at 8 P. M., summer time, on a wave-length of 400 meters. The call is "2MT", and the power is only one-half kilowatt.

The Hague concerts are sent out from PCGG on a wave-length of 1,070 meters, every Sunday from 2:30 to 5 P. M. The second part of the program is sent in English for the benefit of the amateurs in Great Britain.

The air station radiophone at Croydon (near London), call GED, uses a wave of 900 meters and may be heard at various times during the day, communicating with the aeroplanes running from London to European cities. Below is a list of other Government radiophone and C.W. stations used for communication with aeroplanes.

Evere, Brussels, Belgium, BAV, C. W. 900.

Bordeaux, France, AB, C. W. 1400.

Le Bourget, Paris, France, ZM, C. W. and Telephone 1400 and 900.

Lyons, France, AL, C. W. 1400.

Maubeuge, France, AV, C. W. 1200.

Nimes, France, AN, C. W. 1400.

St. Inglevert, France, AM, C. W. and Telephone 1400 and 900.

Soesterburg, Holland, STB, C. W. and Telephone 1400 and 900.

Amsterdam, Holland, KLM, C. W. and Telephone 1400 and 900.

Castle Bromwich, Great Britain, GEC, C. W. and Telephone 900.

Didsbury, Great Britain, GEM, C. W. and Telephone 900.

India House, Great Britain, GFA, C. W. 1400.

Lympne, Great Britain, GEG, C. W. and Telephone 900.

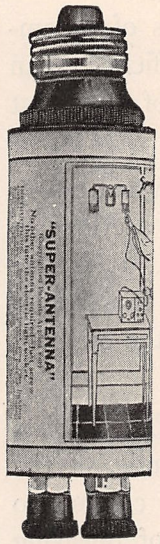
Renfrew, Great Britain, GER, C. W. and Telephone 900.

Department stores in London are now selling radiophone receiving apparatus from regular stock.

A barber in Leeds has attached a wireless aerial to the striped pole over his door, and inside the shop he has a loud-speaking receiver to entertain his customers.

It is said that broadcasting radiophone

Super-Antenna



Saves Cost of Aerial
Attach to Any Light Socket

The "Super-Antenna" unit has been designed by one of the country's foremost engineers for Radio Vacuum Tube Reception over electric lighting circuits.

You can now pick up broadcasted concerts in any room or at the home of a friend by simply attaching the "Super-Antenna" plug to any electric light socket.

The "Super-Antenna" does away with the overhead aerial and the dangers of stringing wires. Eliminates expense of switches and lightning arresters. **Safeguards your Set—Will not blow fuses and is absolutely shock proof.** Operates on any electrical circuit from 32 to 120 volts, D.C. or A.C. and does away with alternating current hum. Does not use current. Switch can be turned "ON" or "OFF".

Endorsed by Leading Electrical Institutions

The "Super-Antenna" unit in voltage, weight and design is made to conform with the requirements of the National Board of Underwriters and has been tested and approved by leading electrical experimental stations.

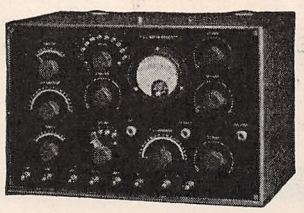
Order at Once—*Today!*

On account of the heavy demand, we suggest you order at once. If your dealer cannot supply you, send check or money order direct giving us your dealer's name.

West of Rockies **$3.00** Canada **$3.70** PRICE **$2.80**

F. R. L. Super-Receiver—Radio Frequency

A high-grade perfect functioning three-stage Radio Frequency Receiver months ahead of any other set on the market. Easily tuned to hear distant points. Perfect modulation of music, speech or signals without distortion.



30 Mile Range Without Antenna or Ground

This unit has 1,000-mile receiving radius and a range of 150 to 600 meters. In addition to this, provision is made for an External Detector and Tuner for other wave lengths. Has no equal for sensitiveness and efficiency. All parts are made and tested according to the most exacting Standards, making certain accurate operation.

Price, including tubes. **$240.00**

DEALERS AND JOBBERS—Be the first in your territory to stock these units. Write at once for particulars.

SUPER-ANTENNA COMPANY

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The Great Southwest has Thousands of Fans and Is a Virgin Field.

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Ask Your Chiropractor for "The Last Word"

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The phenomenal growth and onward sweep of **CHIROPRACTIC** cannot be ascribed to the personnel of the profession. It is due entirely to the correctness of the fundamental idea, to the simplicity of the method, and to the results obtained.

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DETROIT NEWS

Oct. 14, 1922

8.30 to 10.00 P. M.

"Listen In"

Hear the Gibson Melody Maids Concert

WWJ Detroit News Concerts are heard at great distances. Tune in on above date and hear the wonderful music possible on Gibson Instruments. You, too, will want to own a Gibson.
New friends, new pleasures, new and interesting experiences, invitations galore—dinners, dances, week-end parties, outings—are some of the good things playing a Gibson brings into your life.

Gibson *Instruments*

Are easily learned in spare time without previous knowledge of music. A few weeks of pleasant, interesting study and you'll be able to play. And there's no other joy in life quite equal to hearing music you make on your own instruments.

$5.00 Monthly

Buys a Gibson. The ultimate in construction, finish, tone quality and volume. Built like a violin. Adjustable bridge, non-warpable truss rod neck. 30 other exclusive Gibson features. **Guaranteed for life.** Non-Gibson instruments exchanged.

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Send for FREE catalogue, FREE music and information about Mandolin, Mandola, Mando-cello, Mando-bass, Guitar, Harp-guitar, Mandolin-banjo, Tenor-banjo, Cello-banjo, Guitar-banjo. If interested in Agency, check here..... Teacher..... Clip, check and mail this ad **today.**

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6900 Retail Radio Dealers covering the United States, by states, price per thousand $7.50.

838	Radio Manufacturers	per list	$10.00
1022	Radio Supply Jobbers	" "	10.00
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14000	Radio Amateurs and Managers of Radio Stations	per M.	7.50

These are neatly typewritten and ready to send you on receipt of remittance covering the amount; guaranteed 97% correct.

TRADE CIRCULAR ADDRESSING CO.

166 W. Adam St., Chicago, Illinois

stations will soon be erected in areas centering on London, Cardiff, Plymouth, Newcastle, Birmingham, Manchester, Edinburgh, Glasgow, and Aberdeen. The wavelength will probably be 400 meters.

Variable Condenser from Photo Plate Holder

(*Continued from page* 661)

construction of an efficient variable condenser involving a very small amount of work as detailed below.

Remove the thin hard rubber slides, as they will not be required. With a broken hack-saw blade cut a slot in the end of the holder midway between the two slots from which the slides were removed and of about the same thickness and width as these two slots. Through the new slot remove the black paper diaphragm which separated the photographic plates and on the other end of the holder cut an opening in the center about ½"x⅛" to receive the connectors from the two inside fixed plates.

Procure a sheet of good straight zinc about 8"x36" and cut into seven pieces, three of them being of the same dimensions as the hard rubber slides. These plates form the sliding element and are joined together at one end by the screw R and the five clamp nuts N.

The two inside fixed plates are the same size as the photographic plates and the two outside ones have the overall dimensions of the plate holder.

Cut six pieces of rather heavy straight cardboard the size of the inside fixed plates (5"x7") and immerse them in melted paraffin. While still warm, put them quickly upon the fixed plates in proper position, scraping off surplus paraffin. They will adhere firmly, holding the plates straight and rigid. The outside fixed plates have cardboard on one side only and are fastened to the plate holder by small wood screws.

On one end of each of the inside fixed plates solder a piece of thin sheet brass about ⅜"x1½", which, extending through the hole in the end of the holder, are bent and soldered to the outside fixed plates and to one another. The inside fixed plates are held in the holder by the small flanged locking bars which hold the glass plate in position. It is well to immerse the plate holder in hot paraffin before the slides are inserted, removing surplus material by holding near a gas jet.

This condenser will have considerable more capacity than the ordinary 43-plate rotary type, but this capacity may be easily reduced, if desired, by removing one or two of the plates, preferably the central sliding one.

The plate holder may be set edgewise in the cabinet on insulating supports, requiring very little room, and the sliding element may be adjusted by a rubber or bakelite rod extending through the end of the cabinet, or, if finer adjustment is desired, a rack and pinion may be operated by a knob in front of the cabinet.

If greater capacity is required two or more such plate holders may be placed side by side, with great economy in space, and fine adjustments may be obtained by operating each holder, or even each plate, independently of the others.

For the cardboard insulating sheets, one or more thicknesses of micanite or other insulating papers may be mounted on the fixed plates, using shellac instead of paraffin, but the construction above outlined is easier and will give excellent results.

4 MN

Radio 4MN has been assigned to J. V. Settle, Winder, Ga., who has two 5-watters Acme 200 rectified A.C., radiation 1.6 amperes.

Who Will Save the Radio Amateur?

(*Continued from page 625*)

give the radio amateurs the standing they should have.

We wish to state right here that we have no axe to grind with any organization, club or league, and if the thing is to be accomplished only through an organization we would be just as much in sympathy with such an idea as with any other.

What we wish, therefore, fellow-amateurs, is a manuscript of not more than 1,000 words, setting forth your idea as to the best plan to put the radio amateurs on a solid footing, where they can perform the greatest good for the community and for the radio art. The following, all of them past or present amateurs, will act as judges:

H. GERNSBACK,
Editor RADIO NEWS.
LOUIS GERARD PACENT,
President, Pacent Electric Co.
ROBERT E. LACAULT,
Associate Editor, RADIO NEWS.
ARMSTRONG PERRY,
Author.
LEWIS MASON CLEMENT,
of Western Electric Co.

All the prize-winning letters will be published in rotation, and the editors reserve to themselves the right to publish all manuscripts, even though such should not win a prize. In publishing such manuscripts, full space rates will be paid.

Should two or more contestants submit the manuscripts judged to be the best, second best, etc., each will be awarded the full amount of the prize offered.

This contest will close in New York, November 15, 1922, and the prize winners will be announced in the January, 1923, issue of RADIO NEWS.

Address all manuscripts to *Editor,* "$500.00 Amateur Prize Contest," care of this publication.

Pocket Radio Again

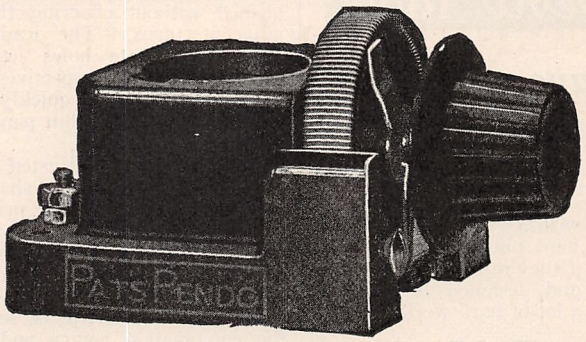
(*Continued from page 629*)

The set weighs only three ounces, but will respond to signals from distances equal to those covered by regular instruments of large dimensions and with equal intensity. It covers all wave-lengths between 150 and 700 meters when used in connection with an antenna whose natural period is about 200 meters.

The case was turned from a solid block of hard rubber and is 2″ in diameter with a 3/16″ wall. It was grooved in front to receive a standard watch crystal, and in back for a 1/16″ hard rubber disc attached with screws, which protects the wiring and excludes dust.

Tuning is accomplished by means of knurled discs of rubber which project slightly through slots in the case, similarly to the celluloid score-keepers used in baseball games. These discs are fastened rigidly to the switch arm shafts so that by pushing on the rim, the shafts and switch arms are revolved. Stops are provided which engage with projections on these discs, causing the switch arms to stop on the end contact points. Connection to these movable arms is through hair springs fastened to the shafting. The contact points are made of brass rod 1/16″ in diameter and are fastened to a circular panel in the tuner with screws about 1/16″ long, eighty threads to the inch.

The tuning inductances are bank wound, without cores, with No. 32 S. C. and a 1/16″ air gap between primary and secondary. They were wound on wooden forms covered with paper and removed after shellacking to bind and stiffen the turns. Taps



KING
Rheo-Socket
another
Radio Surprise

Price $3.00, f. o. b. N. Y. C.

Compact, increased efficiency, shorter connections, less wiring. Brings in stations you never heard before. Make this a part of your up-to-date set.

A high grade article in Red Bakelite with Phosphor-Bronze Contacts and Alloy Resistance Wire.

For Base or Table Mounting

KING AM-PLI-TONE
82 Church St., New York

Manufacturers of the Famous King Am-pli-tone

Jobbers—wire or write for proposition

RADIO WIRE

SHIPPED PROMPTLY — OVER FIFTY TONS IN STOCK

MAGNET WIRE—AERIAL WIRE—LITZ WIRE

Size	ENAMEL 1 lb.	½ lb.	¼ lb.	SINGLE COTTON 1 lb.	½ lb.	¼ lb.	SINGLE SILK 1 lb.	½ lb.	¼ lb.
22	$0.48	$0.28	$0.16	$0.95	$0.52	$0.30	$0.95	$0.51	$0.38
24	.55	.31	.18	1.05	.57	.32	1.07	.57	.21
26	.60	.34	.19	1.21	.65	.36	1.19	.63	.34
28	.64	.36	.20	1.36	.73	.40	1.44	.76	.40
30	.68	.38	.20	1.70	.89	.48	1.89	.98	.51

POSTAGE EXTRA

BANK WOUND VARIOCOUPLERS, 150 TO 3000 METER RANGE, $6.00

Send 5 cents to cover postage on our new perpetual catalog — *No stamps accepted*

I. R. NELSON CO. Broadcasting Station W-A-A-M **Bond St., Newark, N. J.**

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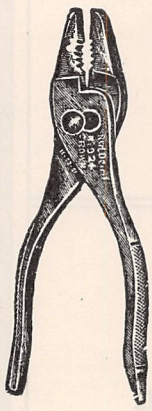
You'll have need for a real pair of pliers!



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"Red Devil" Slip Joint Pliers 924, 6½ inch, combines a shear cutter, burner grip, and screw driver.

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Engineering enables graduates to secure good positions and promotions. Theoretical and Practical Electricity, Mathematics, Steam and Gas Engines and Mechanical Drawing. Students construct dynamos, install wiring and test electrical machinery. Course with diploma complete

In One Year

Over 3000 men trained. Thoroughly equipped fireproof dormitories, dining hall, laboratories, shops. Free catalog. 30th year begins Sept. 27, 1922.

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A. W. WICKS, President WICKS ELECTRICAL INSTITUTE
Dept. 1077 3601 Michigan Ave. CHICAGO

were taken by soldering leads of No. 36 wire, a delicate operation which was accomplished without charring the insulation of adjacent turns. The leads were carried through separate holes in the panel and soldered to their respective contact screws. This had to be done quickly to prevent heat from softening the thin panel and loosening the contact.

The detector is adjusted by means of a small knob attached to a shaft which carries the elbow of bronze wire projecting through a slot in the panel, as may be seen in the photograph. A hair spring bears on the galena crystal and is soldered to the end of the bronze elbow directly over the center of the crystal. It will be seen that through the combination rotary and sliding motion that may be given the detector adjusting knob, the hair spring contact may be raised from the crystal and moved to a new position, where it is brought down again by a spring strip on the back of the panel which bears on a projection of the shaft carrying the knob. The galena crystal is mounted with Wood's metal in a rectangular copper box ⅛" x ¼". The surface was ground flat so that the hair spring contact would always bear on the crystal with uniform pressure at all points. The detector parts are of sufficiently rigid construction to hold a sensitive adjustment even when the set is given quite a jolt.

Binding posts for phone, aerial and ground connections are provided, being turned from phosphor-bronze rod and threaded 2-56. A brass post surmounted by a ring provides a convenient way to attach the set to one end of a watch chain.

Carrying out the idea of a complete vest-pocket outfit, a special receiver and head-band were provided. A single 1,000-ohm phone was turned down to the smallest practical dimensions and a groove made for winding on a Litzendraht cord attached to the terminals which can be unwound and connected to the set. An old pair of ear muffs with a light steel head-band was used in making a head-band for the receiver. By cutting off one muff and bending the wire frame of the other into a yoke, which can be snapped into holes in the receiver case, a very light and efficient head-band was made which folds up into a small unit around a spool containing wire for connecting the aerial and ground to the set. The entire outfit is carried comfortably in three vest pockets and when used with the time-honored bed spring antenna, will bring in a surprising number of stations.

THIRTEEN BROADCASTERS LICENSED

List of limited commercial or broadcasting stations licensed between August 12 and 19, 1922.

WKAN—Alabama Radio Mfg. Co., Montgomery, Ala.

Dreyfuss Phones for Long Range Receiving

The extreme sensitivity of Dreyfuss Phones makes them widely popular for long range receiving and listening in on low power stations. Can be used as loud speakers.

Excellent workmanship. Designed by engineers with over 18 years' experience in the radio field. Aluminum backs, rubber caps, finest materials.

2000 Ohm Concert Type
$8.00 List

3000 Ohms, per pair - - - - $12.00

1000 Ohms, single head band set, per pair - - - - - $4.75

Immediate Deliveries!

P. M. DREYFUSS CO., Inc.
150-152 Chambers Street, New York City
29 Cedar Street, Newark, N. J. 179 Greenwich Street, New York City

UNCONDITIONALLY Guaranteed for 3 Years
(A Written Guarantee)

U.S. Storage Batteries
Supreme for Radio Telephone

6 Volts	20 amp.	.....	$7.50
6 Volts	40 amp.	.....	10.00
6 Volts	60 amp.	.....	13.75
6 Volts	80 amp.	.....	17.50
6 Volts	100 amp.	.....	22.50
8 Volts	60 amp.	.....	17.50

9 Cell B	Storage Batteries	22½ V.	$7.50
20 Cell B	Storage Batteries	50 V.	13.75
40 Cell B	Storage Batteries	100 V.	26.00

If your dealer hasn't it, send money order or check direct

Mail Orders Filled Upon Receipt of Price
PRICE LIST MAILED FREE

Dealers Write for Discounts

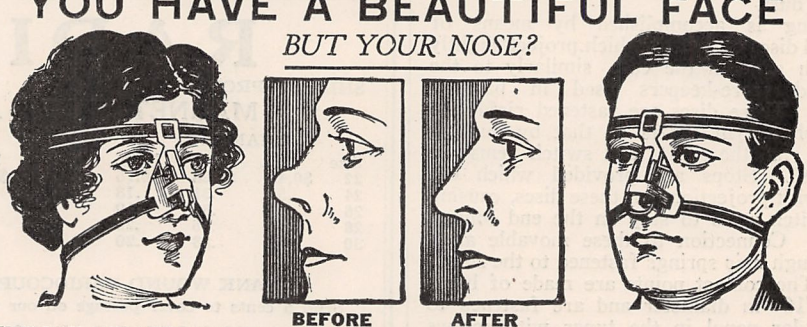
U. S. STORAGE BATTERY CO.
FAR ROCKAWAY, N. Y.

You can be quickly cured, if you

STAMMER

Send 10 cents for 288-page book on Stammering and Stuttering, **"Its Cause and Cure."** It tells how I cured myself after stammering 20 yrs. **B. N. Bogue, 879 Bogue Bldg., 1147 N. Ill. St., Indianapolis.**

YOU HAVE A BEAUTIFUL FACE
BUT YOUR NOSE?



BEFORE **AFTER**

IN THIS DAY AND AGE attention to your appearance is an absolute necessity if you expect to make the most out of life. Not only should you wish to appear as attractive as possible, for your own self-satisfaction, which is alone well worth your efforts, but you will find the world in general judging you greatly, if not wholly, by your "*looks*," therefore it pays to "look your best" at all times. **Permit no one to see you looking otherwise;** it will injure your welfare! Upon the impression you constantly make rests the failure or success of your life. Which is to be your ultimate destiny? My latest *Nose-Shaper*, "TRADOS Model 25," U. S. Patent, with six adjustable pressure regulators and made of light polished metal, corrects now ill-shaped noses without operation, quickly, safely and permanently. Diseased cases excepted. Does not interfere with one's work, being worn at night.

Write today for free booklet, which tells you how to correct ill-shaped noses without cost if not satisfactory
M. TRILETY, Face Specialist - 1774 Ackerman Bldg., Binghamton, N. Y.
Also for Sale at Riker-Hegeman, Liggett's, and other First Class Drug Stores.

KFBJ—Boise Radio Supply Co., Boise, Idaho.
WKAP—Flint, Dutee Wilcox, Cranston, R. I.
KFBK—Kimball-Upson Co., Sacramento, Cal.
WKAQ—Radio Corp. of Porto Rico, San Juan, P. R.
WFAY—W. J. Virgin Milling Co., Central Point, Oregon.
WKAG—Edwin T. Bruce, M. D., Louisville, Ky.
WJAZ—Chicago Radio Lab., Chicago, Ill.
KFBM—Cook & Foster, Astoria, Oregon.
WKAJ—Fargo Plumbing & Heating Co., Fargo, N. D.
KFBL—Leese Bros., Everett, Wash.
WKAH—Planet Radio Co., West Palm Beach, Fla.
WJAX—Union Trust Co., Cleveland, Ohio.

Typing by Radio Perfected

The Bureau of Standards recently explained some experiments by F. W. Dunmore which indicated that a recently perfected radio relay recorder might do away with code operators by printing the code message on a tape so that it could be read visibly by inexperienced men, but now the Naval aerial and radio experts have gone the bureau one better—they print radio messages automatically on a typewriter.

Co-operating with the Radio Laboratory of the bureau, experts of the Navy successfully tested the operation of the line-wire teletype by radio a few months ago, and succeeded in printing messages from a distance of nine miles. The radio circuit was established between the Bureau of Standards near Chevy Chase and the Naval Air Station at Anacostia.

More recent experiments have established the fact that teletypé messages printed on a machine installed in an airplane and transmitted by radio can be recorded on a typewriter in a ground station. Future experiments will undertake the reversal of this operation; the sending machine being on the ground and the receiving apparatus installed in a plane in flight. Great interest is manifested by Naval experts as the new method will permit the sending and receipt of duplicate orders of record, eliminating errors and a knowledge of code, besides saving time of rewriting.

The practical tests made assure future commercial uses in aerial news reporting, when a correspondent covering an aquatic event, marine engagement, or sea maneuvers can send his copy straight to the desk. Another value, if aerial passenger lines are extended, would be the receipt and dispatch of typewritten telegrams, stock reports, news dispatches, etc., ready for delivery.

The sending instrument of the teletype resembles in general the commercial typewriter in that a keyboard having the letters of the alphabet and other conventional symbols on it is arranged so that it may be operated by hand. Each key is connected to the radio installation in the plane, and when a letter is struck on the keyboard a radio impulse is sent out from the antennae of the plane and is received at a ground station. The similarity to the typewriter is completed in the receiving device. When the letter A is struck on the keyboard in the air, the radioactive energy released travels to the recording instrument and selectively energizes the type-letter A, causing it to be reproduced on paper carried in the receiver.

The teletype has been in use for eight years in connection with land-wire operations, but its application to radio use is a recent development. The tests at the Naval Air Station are the first that have ever been conducted in aircraft.

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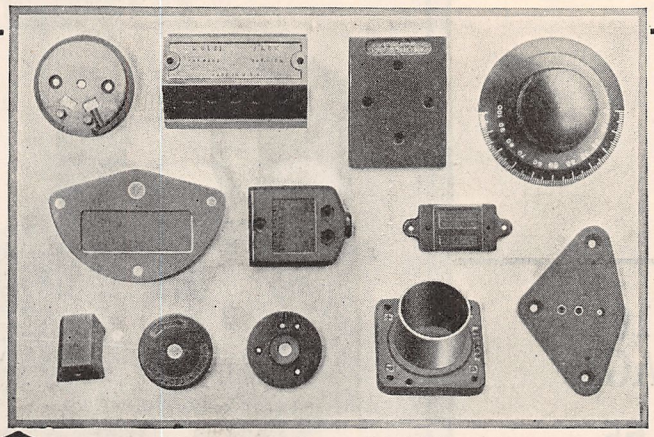

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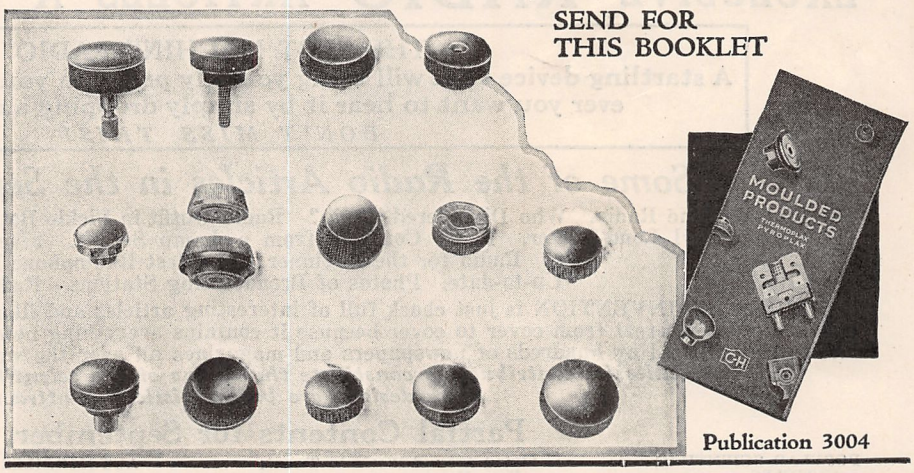

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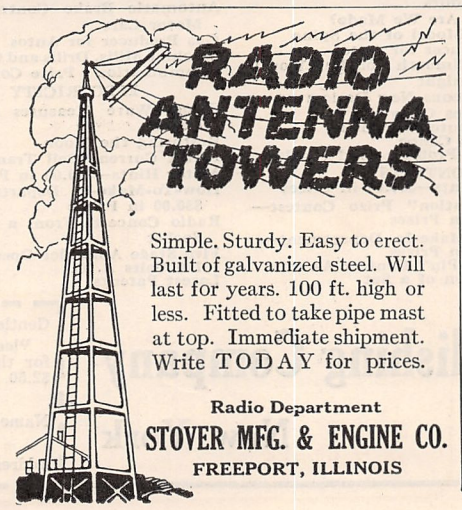

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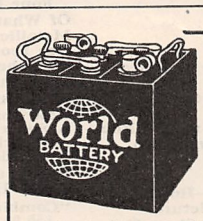

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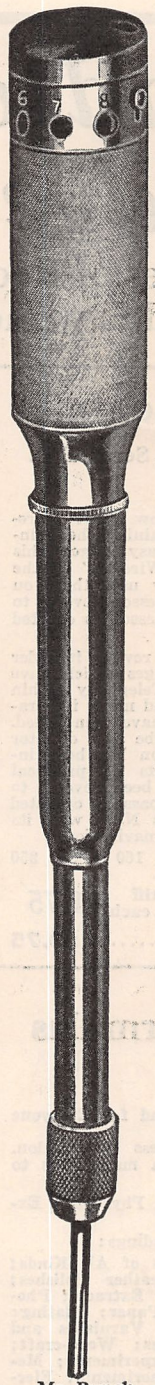

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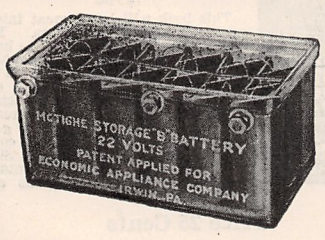

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A REAL TEST FOR TRANS-ATLANTIC RADIO CIRCUITS—CABLE SERVICE IS INTERRUPTED

"An ill wind" may blow radio communication "some good." In fact, it is very likely that the seizure of 10 trans-Atlantic cables by the Irish irregulars, reported by the Associated Press, leaving but seven to carry all the Old World news and dispatches, may give radio communication the opportunity it needs to show what it can do, especially in an emergency. To date it is reported that the Radio Corporation of America is clearing all its trans-Atlantic messages filed between Great Britain and North America without delay.

Officials of the Radio Corporation of America in Washington say they welcome the opportunity to handle the increased traffic and feel that after two and a half years' operation they can handle their share at least. Ordinarily, the R. C. of A. carries between 20 and 25 per cent. of the trans-Atlantic traffic, but now it may get about 70 per cent.

The five commercial cables seized in Ireland terminate in Waterville, the four Western Union at Valentia, and the British cable at Ballingskelligs. The trouble seems to be that if the Government forces attempt to regain the stations the rebels will destroy them, as was the case with the Marconi station at Clifden, which operated to Canada. The three remaining cables direct to Penzance, England, became overloaded at once, and the only radio circuit in operation, that of Carnarvon, is busy night and day.

Radio Corporation officials admit, however, that the Carnarvon station will have to handle both Canadian and United States dispatches, although stations on this continent can relay messages between United States and Canadian points. The radio system is more flexible than cable communication, they point out, and when one station is loaded, part of its work can be transferred to another. High-speed transmission will enable the radio stations to carry great numbers of messages in periods free from interference, and practically no delay is anticipated.

The only other means of communication between the old and new worlds are the three French cables which land at Brest, and one commercial cable to the Azores and Lisbon, which usually serves the Mediterranean, and some of them are said to be in poor shape.

Radio stations in Europe and England are used for sending and receiving from specific sections; for example, the new station at Ongar, England, serves the Continent and Europe; while that at Carnarvon, in Wales, operates to Canada and the United States, and the British Postal radio circuit near Oxford handles Egyptian traffic.

It would seem that the Radio Corporation of America can handle the American end of the trans-Atlantic traffic with little trouble, and the stations at Marion, Mass.; Tuckerton and New Brunswick, N. J.; and Port Jefferson, L. I., will send; while the receiving station at Riverhead, L. I., will do the receiving from Carnarvon, Bordeaux, Stavenger (Norway), and Nauen and Eilvesse (Germany).

Just at this time of the summer, and in fact until late in September, is the worst season of the year for radio transmission, due to static, which will make more difficult the task of radio's rescue of the disrupted cable service, but as the four sending stations can operate in duplex, many messages can be taken care of.

Recently the French-American circuit was shifted from Bordeaux to St. Assise, and after a test conducted with this country the station was opened for operation with co-operation of R. C. A. stations. It is reported that the new radio station just about completed at Bruges may go into circuit

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Radio experts of the Signal Corps have just perfected a new tube transmitting and receiving set for the "Baby" or "Whippet" tanks which will handle both telegraph and telephone messages. So successful was the recent demonstration at Camp Meade with the radio-directed tank which took part in the fight of "Hill 285", leading and directing its brother tanks, that from 30 to 40 new sets have been ordered for the master tank of the Army.

The specifications of the new tank equipment, known as S.C.R. 143, dual telephone and telegraph set, call for a strong and compact set of about 50 watts, which will withstand the jolting of a tank in action over rough terrain and preserve a good tone. It will have a range of from five to ten miles.

Plans of the Infantry arm of the Service, which includes the old Tank Corps, provide for one radio or "signal" tank for each group of Whippet tanks, which will serve as a message and control center for the group. The signal tank will be equipped with a 6′ aerial, the ground being the tank itself. Power for driving a small generator will be derived from storage batteries. A sound-proof helmet with phones, such as air-pilots use, will be supplied for the radio man, so that he can hear despite the rattle of the mechanism and roar of the engine.

The first practical demonstration showed the value of radio equipped tanks. They are not radio controlled, but radio directed. Captain C. H. St. Germain, Signal Officer of the Tank School at Camp Meade, took his station on one side of the maneuvering ground, after the sham battle last week, and, with his headset on and a transmitter in his hand, made the mechanical scout several hundred yards away go through its paces to perfection. At his radio orders it "charged" the hill, executed "by the left flank," "to the rear" and "halt," performing most creditably, directed solely by radio, which might have been several miles away. In actual battle, however, the tank commander would attend to all details as to moving about, relying on battalion or regimental headquarters for such information as when to advance or retreat and where machine-gun nests were located. Such information would be conveyed to the other tanks in the group by visual signals or the movements of the master tank itself, just as in airplane formations.

Future development is seen in the equipment of all tanks with receiving sets, so that inter-tank communication may be had in action, and some prophetic spirits of the Corps foretell of radio control enabling an "Amatol"—or "T.N.T."-filled tank to be sent into enemy lines and exploded—a "creeping torpedo" in fact which would undoubtedly carry fear and destruction into the enemy camp; but that is a subject for future development, although quite possible electrically and machanically.

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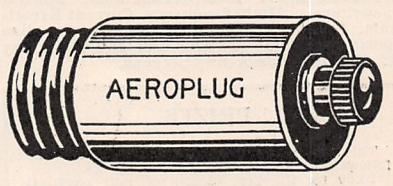

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Although your regular price is $2.00 per year, you will accept my subscription at $1.75 per year (Canada and foreign $2.25). I enclose the money herewith and I have written my name and address in margin below.

R. N. 10-22

in coal and power bills at Pearl Harbor as well as considerable time, and will also aid in clearing Pacific traffic. The perfection of the "barrage" receiver thus makes for far greater efficiency in Pacific radio circuits.

NEW BROADCASTERS

Six Limited Commercial Broadcasting Stations were licensed by the Department of Commerce on August 11th:

WJAQ—Capper Publications, Topeka, Kan.
WAJT—Kelley-Vawter Jewelry Co., Marshall, Mo.
KFBH—Thomas Musical Co., Marshfield, Ore.
WLAJ—Waco Electrical Supply Co., Waco, Texas.
WAJU—Yankton College, Yankton, S. D.
WJAS—Pittsburgh Radio Supply House, Pittsburgh, Pa.

RADIO EXPORTS TOTAL $1,164,514 FOR SIX MONTHS

American radio apparatus is beginning to be exported in considerable bulk, and in June shipments amounted to over half a million dollars, which is the greatest value of radio exports for several months. Experts of the Electrical Division of the Department of Commerce say that radio is only a part of recent gains in electrical exportations, which for June were $2,000,000, greater than in May, being indicative of our recovery of export trade in electrical supplies and equipment.

Our total export values for radio equipment during the past six months amounted to $1,164,514, June being the best month, with exports valued at $547,364 and totaling nearly a million pounds of goods. The value for June was almost three times the exports of radio equipment for May. A sort of boom in the shipment of American radio goods to foreign countries started in February, which month saw the exportation of $283,950 worth. There was a slump in March, during which only $21,180 worth was shipped out, but in April the figures rose to $116,221, while for May they increased to $186,364.

The fluctuation is said by experts to result from occasional big orders which are completed during certain months and shipped out, the orders keeping to a more regular curve. In February, for example, the bulk of the shipments went to Poland and Danzig, where big radio stations were being built, boosting the export figures by $258,094. The only other shipments of any size were to the British West Indies and the Philippines, which totaled only about $20,000 together. Britain, Panama and Japan took most of the radio apparatus in March, and in April Poland and Danzig got $12,790 worth, while Quebec and Ontario, Mexico and Cuba imported about seven times that value. During May, Ontario received $118,836 worth of radio goods, Mexico $14,044 and England $13,444.

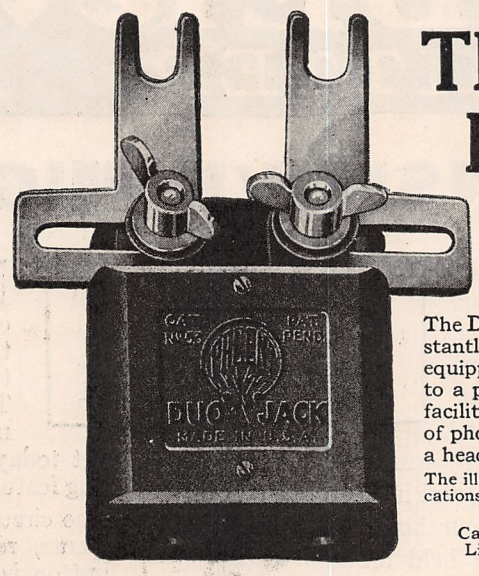
AMERICAN EXPERT INVESTIGATES ABROAD

Denmark has evidently caught the prevailing "Radio" epidemic, as reflected in requests for American wireless telephone apparatus listed in trade opportunities filed with the Department of Commerce. Australia and Italy also have buyers seeking American electrical equipment.

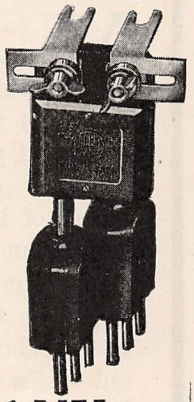
To make a study of foreign electrical development, including wireless operation and equipment, R. A. Lindquist, Chief of the Electrical Equipment Division of the Department of Commerce, sailed for Europe recently. During a three months' survey, Mr. Lindquist will investigate the electrical appliance possibilities for American equipment in England, Sweden and Germany.

A New Member in the PACENT Plug and Jack Family

THE PACENT DUO JACK



This new Pacent Radio Essential, like all previous members of the Pacent Plug and Jack Combination, fills a definite existing Radio need.



The Duo Jack enables you to instantly convert an ordinary set equipped only with binding posts to a plug and jack set. It also facilitates connecting two pairs of phones or a loud speaker and a headset to your receiver.

The illustrations suggest many applications for this very ingenious device.

Cat. No. 53 List Price **$1.50**

The Pacent Duo Jack will be in production by October 1, but dealers and jobbers are advised to place advance orders at the earliest possible date.

PACENT ELECTRIC COMPANY
INCORPORATED

Executive Offices:
22 Park Place, NEW YORK
Telephone Barclay 9670

Branches:
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CHICAGO, ILL. 33 So. Clinton St.
WASHINGTON, D. C. Munsey Bldg.

Members Radio Section, Associated Mfrs. Electrical Supplies

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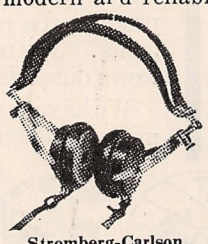
All orders with remittance promptly delivered, Post or Express paid. Always a large and varied stock of most modern and reliable Radio Equipment and Parts.



Stromberg-Carlson No. 2-A Headset
$7.50

Immediate Deliveries on All Items Listed

Aeriola Senior Westinghouse Receiver	$65.00
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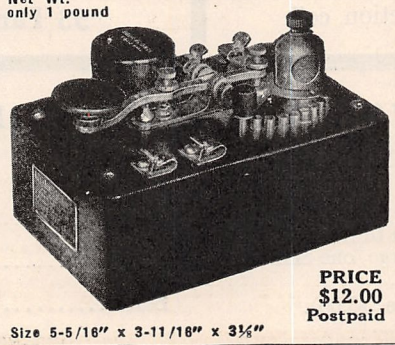
DeForest 2-Stage Amplifier DT 800, less Bulbs and Batteries	35.00
Simplex Variometers	6.00
King Amplitone Horns	12.00
Holtzer-Cabot Headset	8.00
UV 200 Radiotron Detector Bulbs, each	5.00
UV 201 Radiotron Amplifier Bulbs, each	6.50
No. 766 Eveready VT Batteries, each	3.00
Gould 6 volt, 60-80 ampere Storage Batteries.	19.00

Enclose Certified Check or P. O. Money Order with Orders

R-3 Magnavox Loud Speaker **$45.00**

DOUBLEDAY-HILL ELECTRIC CO.
WASHINGTON, D. C. *Dealers—Write for Discount* PITTSBURGH, PA.

Net Wt. only 1 pound



Size 5-5/16" x 3-11/16" x 3½"

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RADIO BLINKER RECEIVING SET
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Pat. Sept. 4, 1917—Oct. 12, 1920—Pat. Pending

(1) A practical, efficient, self-contained Wireless Receiving Set for Radio Phone Broadcasting and Commercial Stations approximately 150 to 800 meters wave length. A newly designed, dust proof, crystal detector, extremely sensitive. Can be quickly adjusted by means of buzzer test and locked in position.
(2) A miniature Sending Set within limits of buzzer radiation.
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Ready for phones, aerial and ground connections. Sold on merit with our usual guarantee. Buy from your dealer or direct from us.

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RADIO EXPERIMENTERS!!

SKINDERVIKEN TRANSMITTER BUTTON

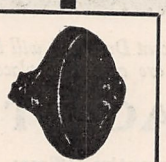
MOST SENSITIVE MICROPHONE

AS A PREMIUM

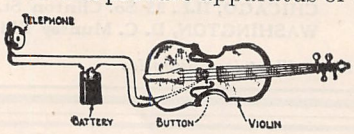
YOU can easily make a highly sensitive detectophone by using a Skinderviken Transmitter Button to collect the sound waves. You can build your own outfit without buying expensive equipment. Think of the fun you would have with such an instrument! It's very simple, too, and inexpensive.

You can install an outfit in your home and hear the conversation being held all over the house. You can connect up different rooms of a hotel. *This outfit was used by secret service operatives during the War. It is being used on the stage.*

So much for its commercial adaptations! *You* can procure apparatus of the same type.

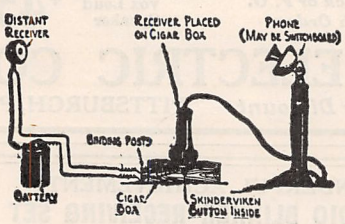


Actual size.



One of the main advantages of the Skinderviken Transmitter Button lies in its ultra-sensitiveness. You can place it in any position you like. It is the greatest invention in microphones and has won recommendations from men of high standing in the scientific world It is being used all over the world. You can mount it most anywhere. Card board boxes, stove pipes, stiff calendars and hundreds of other places will suggest themselves to you. The buttons cannot be seen by any one in the room as they are so small and light. Only a small brass nut is exposed to the view.

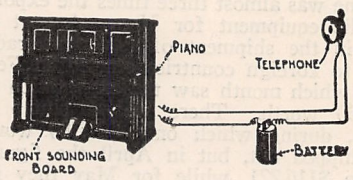
The only instruments needed to complete a detectophone outfit, in addition to a Skinderviken Transmitter Button are a receiver, battery, and, if desired, an induction coil.



MR. H. Gernsback, editor of this magazine, who is the dean of electrical experimenters, said: "In the writer's opinion, obtained by actual elaborate tests, the Skinderviken Transmitter Button is probably the most efficient device of its kind on the market today, due to its simplicity and other outstanding features. Should have a great future."

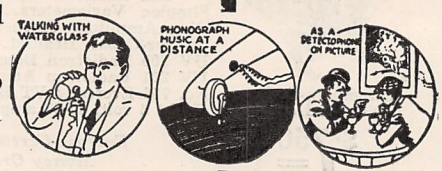
The same circuit connections apply to all experiments, regardless of how the transmitter button is mounted.

The button may be used to amplify RADIO SIGNALS by using it in a local circuit. It should be mounted on the diaphragm of a telephone receiver connected to the radio set and in circuit with a battery and a telephone induction coil. A wire should be soldered to the diaphragm to make good contact or to the case of the receiver if it is a metallic one. A low resistance phone is used in the primary circuit of the coil.



The Skinderviken Transmitter Button operates on one or two dry cells. It often happens that two cells produce too much current and the sounds are deafening. We recommend either one fresh cell or two worn out cells.

We have acquired a limited amount of these Transmitter Buttons and offer same free to our subscribers as a Premium, with a one year subscription to RADIO NEWS. These Buttons sell everywhere for $1.00 and are worth it. We send you one prepaid upon receipt of the coupon below and the subscription price of our magazine. Do it today.



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Enter my order for one year's subscription to RADIO NEWS and send me as special premium, free of charge, one Skinderviken Button.

Enclosed find $2.50 (Canadian and Foreign, $3.00).

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Address.....

Town.....

State.....

THE NAVY LEADS IN ELECTRICAL DEVELOPMENT

Considerable credit is always given the Navy for its pioneer work, in many lines, among them electrical development, but a recent conversation with an officer of the Radio Section revealed the following items which are not generally known:

In the electrical field the Navy was the pioneer in many lines. Starting with the incandescent lamp, every new electrical discovery was fathomed and adopted by the Navy before its commercial use had been found practicable or profitable.

The Navy Department enabled the General Electric Company to produce the first electrically propelled ship in the collier Jupiter, now the airplane carrier Langley.

The radiophone, which through broadcasting has become the talk of the country, is simply the coming into commercial use of a development that has been in general use in the Navy for the last five years. It was installed experimentally in 1907 for communicating between the ships of a fleet.

Many of the great radio telegraph plants that now encircle the globe are owned and operated by the Navy. Without the Navy's interest, experiments and research, as well as their substantial contracts for apparatus, the radio industry in this country, it is said, would be in foreign hands.

The radio compasses that flank our great seaports are owned and operated by the Navy, but through their use any vessel can be told to a degree what her direction is from any station within call, and thus fix her position whether in fog or storm. This makes for better navigation and saves many a big liner from disaster as well as delay in making port.

Static interference is an element to be reckoned with in all phases of radio work, and has never been entirely eliminated. The Navy Department, however, has been engaged in research work looking to the elimination of static longer than any other Government department. While results have been attained which have reduced interference from this source to about half, it has not yet been completely removed.

WORLD TRADE NEWS BY RADIO

Since the recent decision of the Department of Commerce to have foreign commercial data broadcasted from radio stations in the neighborhood of its 34 district offices, schemes for the improvement of this service, particularly in the saving of time, have been received from several sources. One of the recent suggestions is that radio receiving sets be installed at all the branch offices of the department so that commercial data broadcasted from Government stations in Washington and other important centers may be received without delay and re-broadcasted locally. The plan is now being considered by the Bureau of Foreign and Domestic Commerce, and if a favorable report is made the department may be in the market for 34 A-L receiving sets. It is readily admitted by officials that much time would be saved in relaying the information from the Washington headquarters and getting a wide broadcast for the whole country, but fears are entertained that an appropriation for purchasing the receiving sets might not meet with the approval of an economically inclined Congress.

A great mass of foreign trade information is received by the department daily and released to the press, but much of it fails to reach all interested parties. For this reason a scheme of forwarding it by wire to the 34 central and co-operative offices in different sections of the country for broadcasting has been undertaken, and it is to improve this service that the use of radio for transmitting the data and news is suggested.

75¢ each

Perfect Broadcasting Reception with this Mica Condenser

Here we show the new Dubilier Micadon Type 600. It is a perfect Dubilier mica condenser. Use it and all the tube noises, due to fluctuations in the capacity of ordinary condensers disappear.

Dubilier Micadon Type 600 lasts indefinitely. Its capacity is *permanent* because the condenser elements are pressed together, so that they cannot dilate and contract with the oscillations in the antenna and thus cause the capacity to vary.

Dubilier Micadon Type 600 is provided with Fahnestock connectors and grid-leak clamps, but not with grid-leak. The grid-leak can easily be removed and replaced with the fingers.

Everything is soldered. The container is of molded composition. Provision is made for holding screws.

Price in capacities .001 and .002 mfd, 75c each, *without* grid-leak mounting.

Price in capacities from .0001 to .0005 mfd, 75c each, *with* grid-leak mounting.

Price in capacities from .0025 to .005 mfd, $1.00 each.

Order from your dealer

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Department RN

48-50 West 4th St., New York

Branch Office, Munsey Bldg., Washington, D. C.

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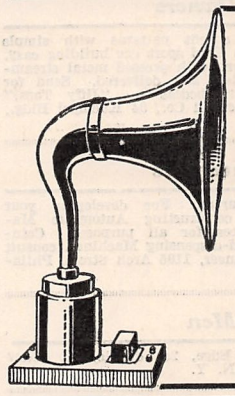

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MONEY for You—Add to your Salary—Make extra Pin Money. Start a lucrative business of your own. Spend an hour each day taking subscriptions for the "Radio News." We'll pay you well and you'll enjoy the work. Write for full particulars. Circulation Dept., RADIO NEWS 53 Park Place, N. Y. C.

OPPORTUNITY AD-LETS

Follow these advertisements every month. Reliable advertisers from all over the country offer their most attractive specials in these columns.

Classified advertising rate fifteen cents a word for each insertion. Ten per cent discount for 6 issues, 20 per cent discount for 12 issues. Name and address must be included at the above rate. Cash should accompany all classified advertisements unless placed by an accredited advertising agency. No advertisement for less than 10 words accepted.

Objectionable or misleading advertisements not accepted. Advertisements for the December issue must reach us not later than October 1st.

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Tailoring Agents—We've got a wonderful line of all wool tailored to order suits and overcoats to retail at $29.50. They're all one price. $20 cheaper than store prices. You keep deposits, we deliver and collect. Protected territory for hustlers. Write J. B. Simpson, Dept. 173, 831-843 W. Adams, Chicago.

Your chance to make Big Money silvering mirrors, auto reflectors, metalplating. Outfit furnished. Write for particulars. International Laboratories, Dept. 48, 309 5th Ave., New York.

Great Profits Assured capable men joining immediately national selling organization for Evenflo Self-filling Inkpencil pen. Writes with ink instead of lead. Send for Profit Proposition. Evenflo Pen Company, Dept. 64, Grand Rapids, Mich.

We Wish Representatives in every community to secure subscriptions for Radio News, Science and Invention, and Practical Electrics. This is a wonderful opportunity for Amateur Radio Enthusiasts to make big money quickly. Write Experimenter Publishing Co., Inc., 53 Park Place, New York City.

Amateur Agents Wanted in every city and town to sell radio apparatus. A few stocking agencies still open. Delfelco, 12 Meeting Street, Pawtucket, R. I.

Ambitious men, write today for attractive proposition, selling subscriptions to America's most popular automobile and sportsman's magazines. Quick Sales. Big profits. Pleasant work. Digest Pub. Co., Butler Bldg., Cincinnati.

$75.00 to $150.00 Weekly. Free samples. Lowest priced gold window letters for stores, offices and autos. Anybody can do it. Large demand. Exclusive territory. Acme Letter Co., 2800M Congress, Chicago.

Big Money and fast sales. Every owner buys gold initials for his auto. You charge $1.50; make $1.35. Ten orders daily easy. Write for particulars and free samples. American Monogram Co., Dept. 133, East Orange, N. J.

Agents Wanted in every city and town to sell standard radio apparatus. Attractive discounts given. If interested, write us at once stating age and radio experience. Wilmington Electrical Specialty Co., Inc., 912 Orange St., Wilmington, Delaware.

Agents wanted. We pay $25.00 to $200.00 weekly. Write Fragrant Bead Company, 2432 Bolton Street, Philadelphia, Pa.

No dull times selling food—people must eat. Federal distributors make big money; $3,000.00 yearly and up; no capital or experience needed; guaranteed sales; unsold goods may be returned. Your name on packages builds your own business. Free Samples to customers—Repeat orders sure. Exclusive territory. Ask Now! Federal Pure Food Co., Dept. 68, Chicago.

Make $5,000.00 every year—$2,000.00 spare time. You share profits besides. Show "Weather Monarch" Raincoats and Waterproofed Overcoats. Ask about "Duol Coat" (No. 999). Free raincoat for your own use. Associated Raincoat Agents, Inc., B-448 North Wells, Chicago.

Help Wanted

Electrical Sales Engineer, familiar with Radio, with equipped office, Phila., Pa., open for connection with manufacturer or distributor. H. W. Marks, 1420 Fairmount Avenue, Phila., Pa.

Earn $25 Weekly, spare time, writing for newspapers, magazines. Experience unnecessary; details free. Press Syndicate, 5665, St. Louis, Mo.

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Make money at home making toys and novelties. Send 5c for catalogue and particulars. New Specialty Co., 417 E. 71st Street, New York.

Become a Landscape Architect. Dignified, Exclusive Profession. Little competition. $5,000.00 to $10,000.00 income for experts. Easy by our method. Begin earning 3 weeks after you enroll. Write today. American Landscape School, 11R, Newark, N. Y.

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Correspondence Courses at less than half original prices. Any school; any subject for men or women. Bulletin 1074 free. Courses bought. Instruction Correspondence Exchange, 1966 Broadway, New York.

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Automobile Mechanics, Owners, Garagemen, Repairmen, send for free copy America's Popular Motor Magazine. Contains helpful instructive information on overhauling, ignition wiring, carburetors, batteries, etc. Automobile Digest, 9528 Butler Bldg., Cincinnati.

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Electricians' Examinations: Book of questions and answers with diagrams, symbols, tables, notes and formulas for preparation for license. $1.25 by mail. Aaron Shapiro, 132 West 24th St., New York.

Radio Manual, everything the beginner should know. How to build and operate an inexpensive receiving set. Sixty-four pages, thirty illustrations. Twenty cents. Postpaid. Raydio Publishing Company, Caxton Bldg., Cleveland, Ohio.

Study Human Nature, know people, make more money. Send 10c for "Personal Power," a little book that points the way. Address Progress League, 31-A. G. Union Square, New York, N. Y.

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Vibrations — Light — Color — Sound Literature. Free. Stevens Publishers, 242 Powell, San Francisco.

900 Mechanical Movements, also illustrations explaining 50 Perpetual Motions. My book, "Inventors' Universal Educator," fifth edition, tells how to procure and sell patents. Government and other costs. Covers matter from A to Z. 160 pages elegantly bound, Mechanical Movements greatly assist inventor—suggest new ideas that may prove of great aid in perfecting inventions. Tells how to select an attorney. Has valuable information regarding Patent Sharks and Brokers. Price, $2.00. Postage, free everywhere. Money back if not satisfactory. Explanatory circular free. Fred G. Dieterich, 631 Ouray Bldg., Washington, D. C.

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Radio Building Books, 25c. Amateur Electrician, 10c. Toymaker Books, 10c—64 pages each. 150 kinds mechanical puzzles, leader and catalog, 10c. Western Puzzle Works, 15, St. Paul, Minn.

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Bookkeeping in a week. Dukes, 1857B Walton Avenue, New York, N. Y.

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Inventors and Manufacturers. For developing your invention, designing and constructing Automatic Machinery, Labor-saving Devices for all purposes. Coin-controlled Beverage and Food-dispensing Machines, consult John Frick, Mechanical Engineer, 1105 Arch Street, Philadelphia, Pa.

For Men

Blades Sharpened. One Edge, 2c; double, 3c. New York Edge Co., Glen Cove, N. Y.

Electrical Supplies and Appliances

Electric Tattooing Outfits, Illustrated Catalogue, 10c. Waters Mfg., 1050 Randolph, Detroit.

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Amateur Agents wanted in every city and town to sell radio apparatus. A few stocking agencies still open. Delfelco, 12 Meeting Street, Pawtucket, R. I.

Attention: Dealers, Manufacturers! Hundred cavity mold for making 5/8-inch diameter hard rubber radio knobs Also 10,000 brass inserts for knobs. Write immediately. Garfinkel, 221 Bryson Bldg., Los Angeles, Calif.

Trade—1 K.W. D.X. Transmitter. 2 S.W. Receivers. Like new, for cash. Make offer. Walleze, Danville, Penna.

Amrad Tuner and detector two step, $90.00. Clapp-Eastham H.R. receiver with H.Z. amplifier, mahogany, $65.00. Magnavox R3, $40.00. All new, perfect condition. Send money-order. Ridgewood Orchard, Winchester, Va.

200—20,000 Meter Receiver, including Radiotron. $35.00. Box 205, Williamsport, Pa.

Bargain — Regenerative Receiver, two-step Amplifier. New Oak Cabinets. Each, $35.00. Together, $60.00. Cost, $90.00. Write for description. George Fisher, Main Street, Ramsey, N. J.

Sell, $35.00. DeForest panel honeycomb set. Paul Gleason, Chillicothe, Ill.

Sell or Trade for radio parts, 15 dial omnigraph A1 condition. Write Wesley Kinnan, 32 North Avenue, Canandaigua, N. Y.

For Sale—Broadcasting Station in A1 condition at attractive price. Formerly known as WHQ. The Times Union-Hickson Radiophone Station. For particulars, write Hickson Electric Company, Inc., 36 South Ave., Rochester, N. Y.

Want Radio Set? Write for reduced prices all radio supplies, batteries, tools, sporting goods. Price list free. Anderson, 340 Park Ave., N. Y.

Sale—Complete ½ K.W. spark set; Tuska short wave receiver; Arlington coupler; very cheap; all guaranteed. J. Sweeney, Pearsall, Texas.

Engraving

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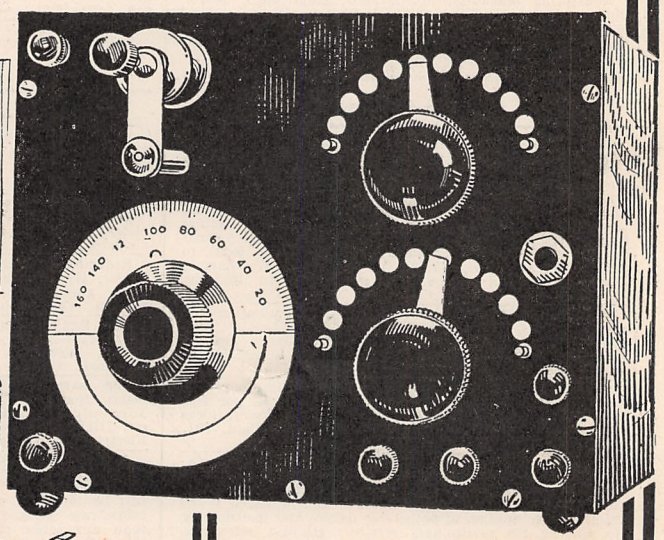

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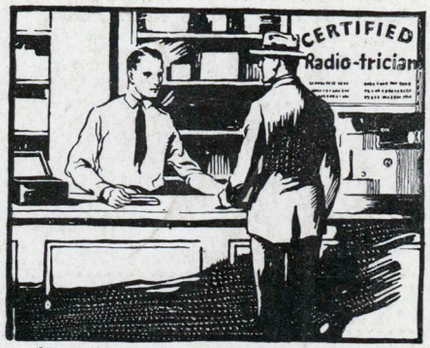

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